August 1957

SIGNAL

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Telescopic Photo Recorder

See Page 3

FRONT-LINE STORY

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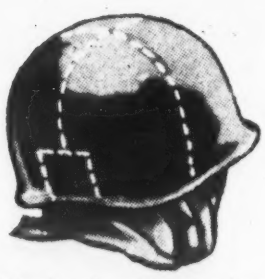
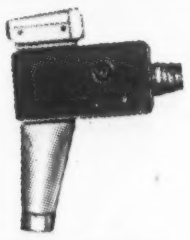


Transistorized radio receiver transmitter completely concealed in helmet has up to 5-mile range.



"Telemite," smallest TV camera, features newly developed RCA ½-inch Vidicon tube, size 1⅞" x 2⅜" x 4¾", weighs about one pound.

RCA Tmk(s) ®

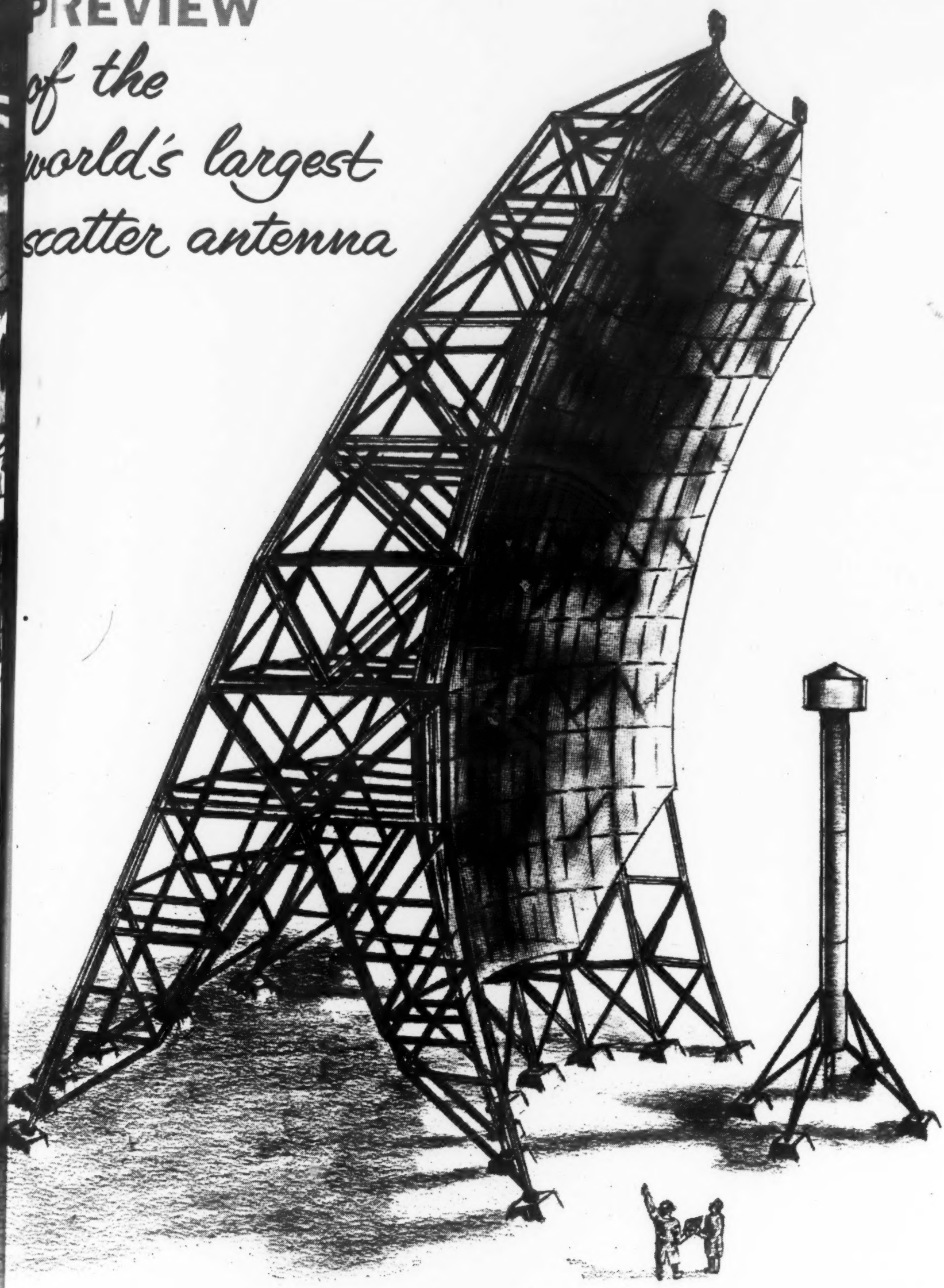
DEFENSE ELECTRONIC PRODUCTS

RADIO CORPORATION of AMERICA

CAMDEN, N. J.

PREVIEW

of the world's largest scatter antenna



A 10-story building could nestle comfortably in the shadow of this giant new Trans-Horizon antenna, now in production at Kennedy's.

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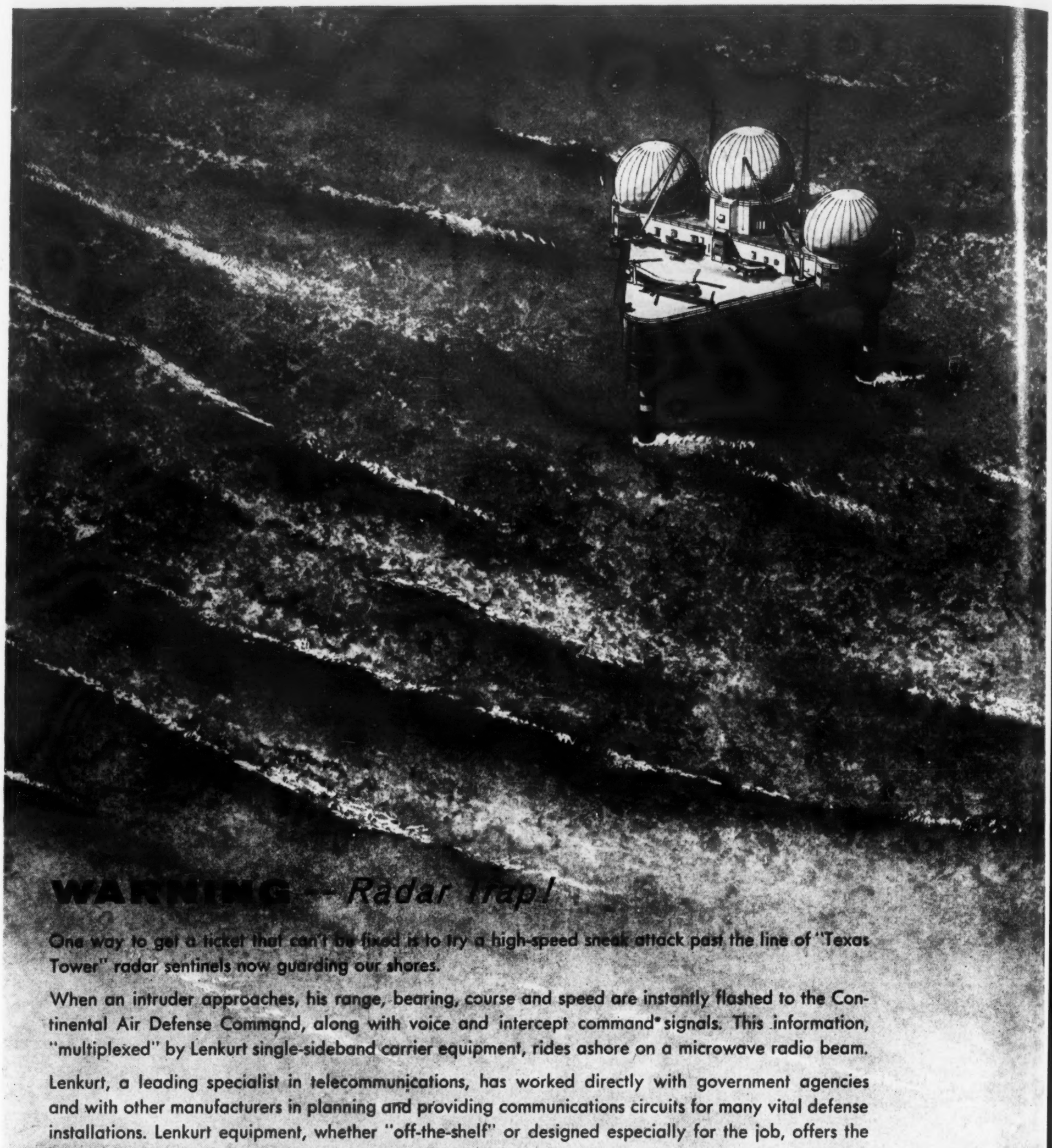

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BPA

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Journal of the Armed Forces Communications and Electronics Association

VOLUME XI AUGUST 1957 NUMBER 12

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Coming in the September issue . . .

"The White Alice Story"—a timely report on the vast new communications system being forged in Alaska, written by William E. Burke, Vice President, Defense Projects Division, Western Electric Company.

"The Golden Era"—Don G. Mitchell, Chairman of the Board and President of Sylvania Electric Products, Inc., deals with technological progress in two major industries, electronics and photography.

"Production Performance and Engineering"—Lieutenant General C. S. Irvine, USAF, Deputy Chief of Staff, Materiel, outlines a new Air Force concept, the "Sub-system Approach," which was adopted to give direction to design, development and production efforts of the Air Force.

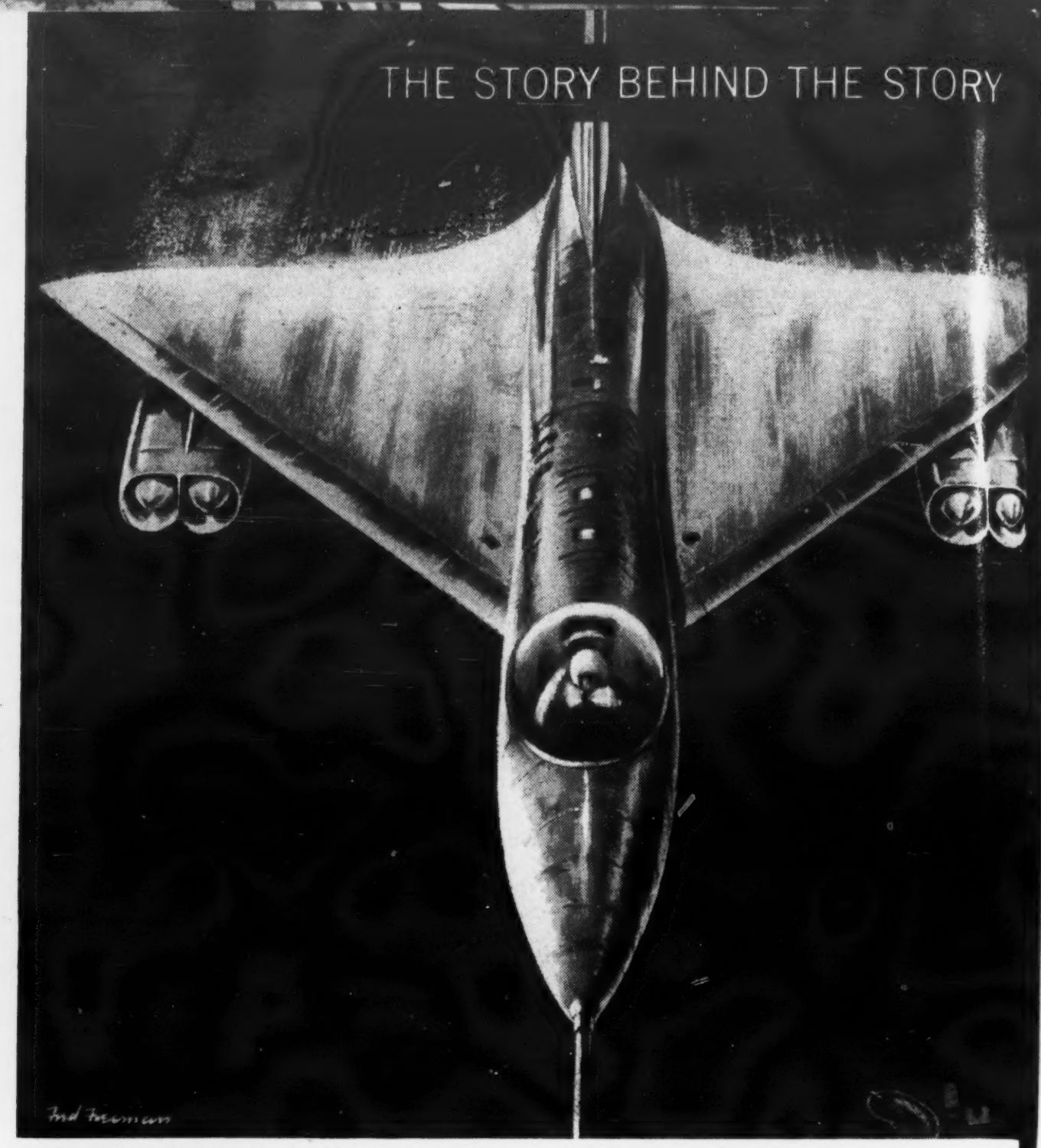
Cover

SIGNAL'S *cover picture shows the Nation's first completely mobile optical tracking system, the Telescopic Photographic Recorder. Capable of photographing a 2 by 7 inch subject at an altitude of 4 miles, the device will be used to record the flight history of missiles, aircraft and bombs.*

Delivered to the Air Research and Development Command, the six-ton system will soon undergo range evaluation tests at Eglin Air Force Base, Florida. It was designed, developed and built by the Perkin-Elmer Corporation of Norwalk, Connecticut.

Authors are entirely responsible for opinions expressed in articles appearing in AFCEA publications, and these opinions are not to be construed as official or reflecting the views of the Armed Forces Communications and Electronics Association.

MISSILE CRUISER–Problem: To launch a missile 1500 miles from target. An error of only 1 degree in launching information would cause a 25-mile target miss.



SUPERSONIC BOMBER–Problem: To navigate undetected for thousands of miles to exact position in space for release of bombs or missiles.

INERTIAL NAVIGATION:

In Its Accuracy Lies Power for Peace

U. S. strategy for maintaining peace by making aggressio unprofitable is based on our ability to deliver a crushing retal atory blow anywhere in the world. Accurate means of directi such blows at long range, high speeds and extreme altitude make would-be aggressors wary of breaking the peace.

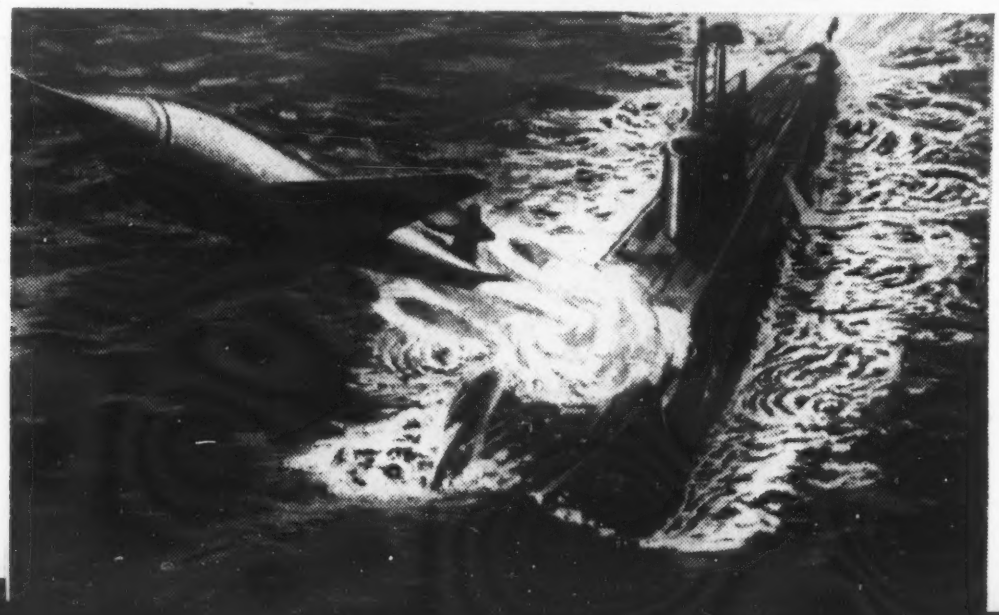
To be effective, weapon carriers must know at all times *exact* where they are. For example, the long-range bomber with i pinpoint target or the pitching cruiser launching missiles far sea must navigate with great accuracy.

Solving such problems is the task of Inertial Navigation syste which furnish all data required *automatically*. Completely se contained within the bomber, ship, submarine or missile, the Inertial Navigation systems require no contact with ground st tions. This is extremely important when military missions mu be carried on without chance of detection.

To design and engineer Inertial Navigation systems involves complex combination of engineering skills–gyroscopics, comp tation, electronics, servomechanics and more. Their producti calls for laboratory precision at every stage. For example, t gyroscopes which form the heart of Inertial Navigation syste must be many times more accurate than those used in commerc navigation.

At Sperry, Inertial Navigation systems are being produced f a wide variety of military applications.

ATOMIC SUBMARINE – Problem: To travel submerged for days and know exact spot to surface for missile firing.



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SCATTER PROPAGATION

- *RAdm. Joseph N. Wenger, USN, Panel Moderator.*
- *Colonel W. A. Ross, USA, Acting Assistant Chief, Army Communications Service Division, Office of the Chief Signal Officer.*
- *Captain W. A. Ellis, USN, Head, Plans and Policy Branch, Naval Communications Division.*
- *Colonel Robert C. Sears, USAF, Chief, Engineering Branch, Office of the Director, Communications-Electronics, USAF.*

Note: This presentation will appear in two installments. Part II will be published in the September issue of SIGNAL.

RAdm. Joseph N. Wenger, USN
Director, Communications and Electronics, Joint Chiefs of Staff

Admiral Wenger:

AT THE REQUEST OF THE DIRECTORS OF AFCEA, THE JOINT Communications-Electronics Committee of the Joint Chiefs of Staff have undertaken to prepare and present a joint discourse on some of the operational aspects of scatter propagation as seen from the military viewpoint.

In discussing this important subject, my role will be primarily that of introducing the representatives of the Army, Navy and Air Force who are to be the principal speakers. They will discuss the uses of scatter mode propagation by their respective Services.

Before proceeding with our program, I should like to insure that we are all on common ground for the discussions. Since scatter mode propagation, as applied to communications, is a relatively new technique, some of you may not have had the opportunity to become familiar with the basic principles and phenomena involved, and others perhaps would like to refresh your minds. Therefore, I shall attempt to review briefly a few of the fundamentals.

Communication beyond the horizon in the high frequency portion of the spectrum is made possible primarily by the reflection of radio waves by the F-layer of the ionosphere. This is the normal method of long range communication with which we are all well acquainted (See Figure 1).

At frequencies above the maximum useable frequencies for this F-layer propagation of radio waves, partial reflection or scattering takes place at the E-layer. This phenomenon has been likened to a glass which has been lightly silvered to give a partial mirror effect. The portion of the transmitted energy thus reflected is minute when compared to the portion of the transmitted energy reflected from the F-layer in the high frequency mode. However, small as it is, the available energy scattered in the E-layer can be usefully employed for communication purposes provided certain measures are taken to enhance the signal at the receiver. This mode of propagation is known as Propagation by Ionospheric Scatter. It is most feasible in the 30 to 55 megacycle band and can provide reliable communication from about 600 to 1400 miles.

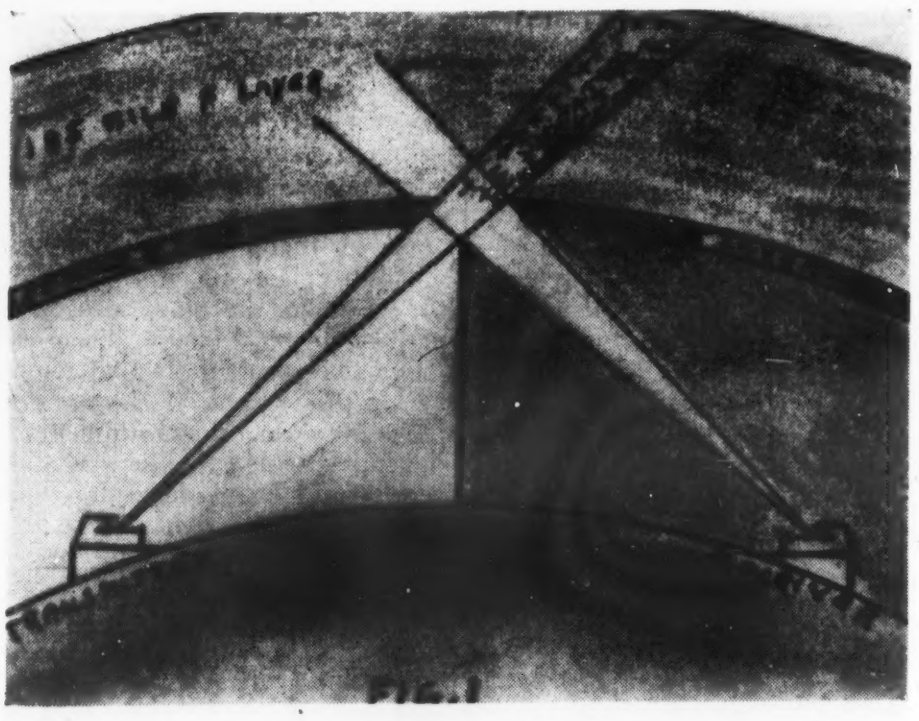


Figure 1

In order to communicate by ionospheric scatter, three conditions must be met. First, the transmitter must be operated at high power, about 40 KW at the present time; second, the receiver must be very sensitive; third, the antennas on both ends of the circuit must be of such design as to give high gain, narrow beam width, and a minimum of radiation in other than the forward direction.

Antennas which have been used with acceptable results are the rhombics, Yagis and corner reflectors. The latter have given best results. Both space and polarization diversity have been used to enhance the reliability of the received signal. In fact, space diversity is considered a requirement on present scatter circuits. In order to achieve the necessary high gain at the operating frequency, the antennas must be physically large. For operation in the far northern latitudes, ice and wind loading are, therefore, important considerations in the design of antennas.

In the auroral zone high frequency operation is often "blacked-out" for long periods as a result of high sun spot activity. During these black-outs the ionospheric scatter mode is enhanced, offering a reliable means of communication during these periods. The use of highly directional antennas further improves our capability in this area.

The requirement for the Armed Forces to operate and communicate in the high northern latitudes has thus brought about installation of the first operational ionospheric scatter circuits in the auroral zone. These will be discussed further in the presentations that follow.

Another scatter technique, which differs somewhat from that just described, is known as Tropospheric Scatter. (Figure 2). The scattering phenomenon in the troposphere takes place primarily when operation is in the UHF range. Transmitted powers in the order of 1 KW to 10 KW, depending on

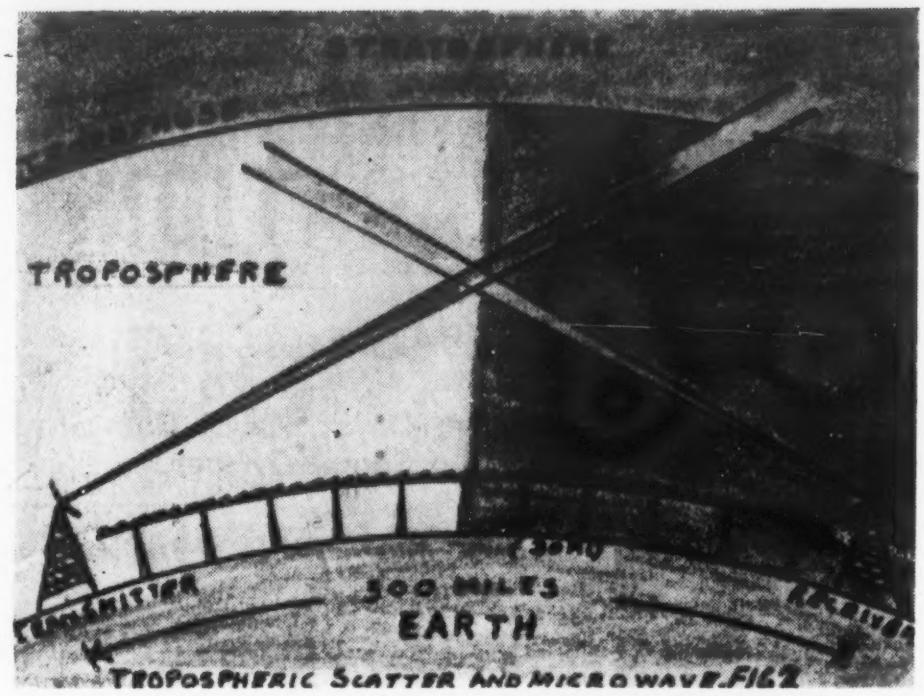


Figure 2

the path requirements, in conjunction with sensitive receivers and high gain antennas, give exceptionally reliable communications. The antennas are paraboloids in the order of 30, 60 or 120 feet in diameter, again depending on the path requirements. Here, too, space and polarization diversity are engineering considerations to enhance the received signal.

Tropospheric scatter mode can provide many channels of voice and teletype up to distances of 350 miles at the present time. It is a desirable substitute for microwave under certain conditions. Short over-water hops, impractical for microwave, are easily bridged by tropospheric scatter. But even over land, where microwave is usually relayed every 25-30 miles, tropospheric scatter can cover 250-300 miles between relays or terminals. This factor not only reduces the number of stations to be maintained, but provides a greater degree of physical security to the system due to the reduced number of stations to be guarded, and a greater degree of equipment reliability due to the reduced quantity of equipment which can fail.

The Joint Communications-Electronics Committee of the Joint Chiefs of Staff has developed a plan for overseas military ionospheric scatter circuits. The plan is world-wide in scope and is completely joint in relation to the Armed Services. This plan has the approval of the Secretary of Defense.

The joint plan designates in specific areas of the world a single military service to provide the ionospheric scatter circuitry to be used by all military departments. The Navy is charged with providing circuitry and facilities across the North Atlantic Ocean and between the Continental U. S. and Alaska. The Air Force is responsible for circuits from the Continental U. S. to the Mediterranean area. These circuits are in addition to North Atlantic ionospheric scatter circuits now in operation. The Army is responsible for scatter circuits in the Western Pacific area. Further details of this plan will be given by the speakers who will follow me.

In their presentations, specific data will also be given concerning the reliability and economy of scatter circuits. It should be emphasized that although scatter techniques have been used for communication for only a few years, they already have provided the Armed Forces with means of communicating reliably in areas where communication has been difficult at best. We must accept the cost involved to obtain the required reliability. However, the actual cost has not been unreasonable for the results attained.

During the extremely high level of sun spot activity, which we are now experiencing, the maximum useable frequency (MUF) for high frequency communication has risen into the low VHF band. This is the band in which the ionospheric scatter circuits have been operated because of technical consideration. With the advent of a high MUF, some of the ionospheric scatter circuits have been operating in the F-layer reflecting mode, as well as the scatter mode from the E-layer. The high power and high gain antennas, coupled with an exceptionally high MUF, have caused some interference with mobile communication in the low VHF band. These same factors have caused low power transmitters for mobile use to interfere with our received signal. As has been previously mentioned, this interference is caused primarily by the extremely high level of sun spot activity which is now occurring, and the degree of interference now experienced can be expected to lessen after the solar maximum has passed.

We do not look upon these two scatter techniques as the solution to all of our communications problems. Both techniques require further study, and, as more information is obtained about the scatter phenomena, surely we can expect to come closer to our goal of 100% reliable communication. Thus far, these scatter techniques have permitted us to increase the reliability of communication in the far North.

The siting problem, dictated by the size of the antennas, the requirement for space diversity, and the critical requirements of terrain for suitable Fresnel zones, imposed a formidable obstacle in some locations. The range limitation was also an important factor. In some cases the high power required for the extreme range forced us to abandon scatter in favor of our old friends, high frequency and microwave.

In summary, I think one can safely say that, although ionospheric and tropospheric scatter are by no means the answer to all of our military problems, they do represent new techniques of great importance to the military Services. Why this is so, I think will be made clear in the detailed discussions that follow.

The next speaker is Colonel W. A. Ross, U. S. Army, Acting Assistant Chief of the Army Communications Service Division, Office of the Chief Signal Officer, who will deliver the Army's presentation.

U. S. Army Presentation

I would first like to discuss some of the tactical considerations of scatter communications. Generally speaking, we believe that tropospheric scatter has the most promise for tactical applications, at least for the immediate future.

The threat of atomic weapons must be considered in the planning of communications networks. Defense against atomic attack calls for troops to be dispersed in small groups with the ability to group for attack. These groups must disperse again rapidly when objectives have been obtained, so as not to present a favorable target. Furthermore, the concept of dispersion will mean that there will exist islands of resistance, with unheld territory between, or even with enemy forces occupying some of the territory between groups of friendly troops.

If the territory in a combat zone must be subject to rapid change of control, the communications networks must be able to function across these unoccupied or enemy held areas. If this area is not held by the enemy, wire may be used but where the enemy controls this area, radio relay or scatter may provide the necessary communications. Let us assume conditions where this area becomes large, so large that the usual radio relay cannot span this area. Attention is then focused on tropospheric scatter which can span the distance of many radio relay links. When such a long span is used the tropospheric terminal equipment may become large and heavy. Antennas about 28 feet in diameter and weighing nearly a ton might be required. Mobility is reduced with heavy equipment and for air lifting the problem becomes especially serious. However, for large areas, such as I have discussed, tropospheric scatter becomes attractive, even with these limitations.

The size of equipment necessary for this means of communications is at present too large. For tropospheric propagation, about 15,000 cubic feet of equipment weighing about 12 tons is necessary to transmit 10 KW. This equipment could be made mobile, but good roads are needed when the equipment is moved.

For tactical operations, further evaluation is required on presently developed equipment and that to be produced in the future.

If equipment size is reduced, it then becomes more attractive, but along with size reduction must come consideration of the various types of modulation, power, antenna structures and frequency of operation.

Actually the future ability of scatter propagation to contribute to the Army communications network appears good. There remain the jobs of selection of equipment parameters, field testing and integration into the communication network. This will take time. Initial equipment will not have the maximum use capability, but will point the way for future development to more nearly satisfy our needs.

The Signal Corps, in meeting the requirement for multichannel medium distance communications, plans to take advantage of the tropospheric scatter mode of transmission. To meet this requirement, the equipment must be mobile, easily installed and require a minimum amount of power. For tactical applications, Radio Set AN/TRC-60 is proposed and is expected to be available for test in approximately one year.

Four vehicles will contain the equipment, as follows:

Truck #1 contains the operating 1 KW power amplifier.

Truck #2 contains modified AN/TRC-24 receiving terminal gear, with low noise front ends, diversity combiners and a telephone Terminal AN/TCC-7.

Truck #3 contains a standby 1 KW power amplifier which is connected to the diversity antenna but which is non-operative under normal conditions.

Truck #4 is used to house and transport the dual diversity antenna system.

The AN/TRC-60 will provide 12 voice channels. This channel capability will be obtained using modified, existing, standardized military radio relay and wire terminating equipments as the basic devices.

Figure 1 shows a comparison of radio relay and the AN/TRC-60. As you can see there are both advantages and disadvantages. A very obvious advantage of scatter in this particular comparison is the reduction of personnel required.

Comparison of 100 Mile Radio Relay & Tropo Scatter Systems

	Total Weight in Tons (Uncrated)		Total Volume in Cubic Ft.	
	100 mi.	200 mi.	100 mi.	200 mi.
Conventional Radio Relay System (AN/TRC-24) with 25 mile hops.	7.83	15.25	650	1266
Tropo Scatter System (AN/TRC-60) with 100 mile hops.	5.18	10.35	770	1540

	Estimated Cost		Estimated Station Personnel	
	100 mi.	200 mi.	100 mi.	200 mi.
Conventional Radio Relay System (AN/TRC-24) with 25 mile hops.	$122,000	$234,000	26	50
Tropo Scatter System (AN/TRC-60) with 100 mile hops.	$105,000	$210,000	12	24

Figure 1. All figures exclude power units and vehicles.

One of the characteristics of tropospheric scatter is the linear decrease in reliability for distance covered for a given case of fixed parameters, i.e., same power, antenna size, band width, etc.

Figure 2 indicates the expected performance of the AN/TRC-60.

The left hand column indicates the relative decrease in reliability of voice transmission for 25% incremental changes in distance between two terminals. While it is true that increased power would compensate for longer distance coverage, practical aspects of tactical communications will limit the size of the power amplifiers and the antennas and consequently the radiated power.

Performance of Radio Set AN/TRC-60

% of Time Terminal Trunk Performance is Obtained

Miles Per Jump	No. of Jumps							
	1	2	3	4	5	6	7	8
75	99.8	99.6	99.5	99.2	99.0	98.7	95	91
100	97	93	90	86				
125	78	62						
150	50							

Figure 2.

For a 150-mile circuit with no repeaters, the reliability is shown to be 50% as compared to a single 75-mile jump with the same power and equipment producing 99.8% reliability.

Two 75-mile hops, which would provide the 150-mile service, would give an overall system reliability of 99.6% as compared to 50% for the single jump system. For the case of a 300-mile system, the relative reliability would be the determining factor between a 4-jump, 75-mile tandem system giving 99.2% reliability as against a 3-jump, 100-mile system producing only 90% reliability—longer tandem jumps being impractical from a reliability point of view.

Now I would like to discuss the use of scatter circuits for long range strategic communications. Probably, the most useful range of tropospheric scatter is two or three hundred miles; therefore the use of this mode in long range communications is obviously limited. Relays provide a partial solution, but there are many cases, such as over-ocean areas, where relays cannot be used. Even where relays are possible there is still the problem of logistic support and physical security. Ionospheric scatter appears to be well adapted to medium range point-to-point communications. In those areas where relay points are available, ionospheric scatter networks, supplemented by tropospheric scatter feeder circuits, may provide an important addition to the long range strategic communications system.

The Army has established an ionospheric scatter system in Alaska and a tropospheric scatter system between Washington and Fort Monroe, Va. Most of the Army's experience in the operational aspects of scatter has been obtained from these two systems.

In 1952 studies were made to determine an appropriate link in the Army global communications network where an ionospheric scatter circuit could be established and where the theoretical advantages could be realized.

It was decided that an ionospheric scatter circuit between Southeastern Alaska and Central Alaska would be satisfactory for this purpose and would fill an operational requirement during the period of experimentation.

A contract was awarded to the Page Communications Engineers, who first made preliminary engineering studies to determine the feasibility of establishing such a circuit and to select appropriate sites.

Sites were eventually selected at Juneau and Kenai, a distance of 607 miles.

Detailed engineering plans and cost estimates for the establishment of this circuit were prepared.

In April 1954, the contractor was authorized to proceed with erection of equipment shelters, antennas, and the installation and testing of the equipment.

The final installation and testing was completed in December of 1955.

Two National FSK-2 equipments were used and provided for 8-teletypewriter-channel operation. This required the use of two AN/FGC-5 time division multiplexers. In addition, a third modulation equipment was installed which provided a narrow band FM voice channel. This voice channel could be used in place of one of the 4-channel teletypewriter groups.

The major items of the transmitter terminal equipment are the two FSK-2 equipments and the voice exciter.

The major items of the receiver terminal equipment are the receiver, monitors, and distribution equipment.

The FSK-2 exciters employ frequency shift modulation using a frequency shift of ±3 KC. The center frequencies of the FSK-2 exciters are operated 10 KC apart. The narrow band FM voice channel is operated on a third sub-carrier frequency which is 11 KC lower than the assigned frequency. The total band width required is approximately 27 KC.

The antenna system consists of three identical 60° corner reflectors. One is for transmitting and two are for receiving.

Each antenna consists of four full wave colinear dipoles fed in phase. The 60° corner reflector is supported from a 9-tower array. The antenna is over 100 feet high. It is about 160 feet across the front. This antenna has a free space gain of approximately 20 db. There is another detail which is of passing interest. This is the moose guard. There were several occasions when moose got all tangled up in the antennas. It was necessary to build a fence around the antennas to keep the moose out.

The equipment is housed in prefabricated steel panel buildings. The small building contains the auxiliary power generators (See photo on page 11).

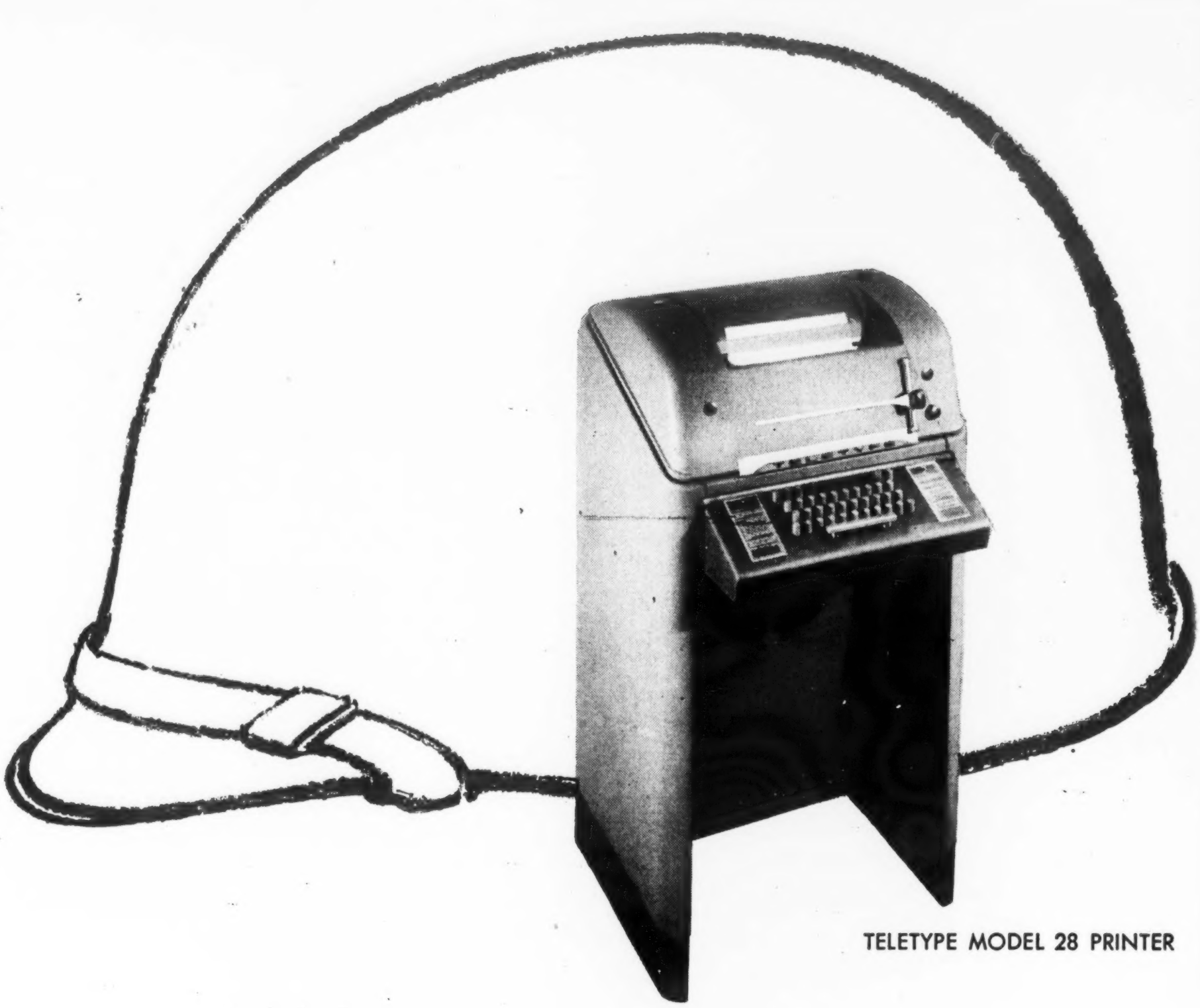
The circuit from Juneau to Kenai used a frequency of 34.4 mc. The circuit from Kenai to Juneau used 36.4 mc.

Prior to turning this installation over to the government, the contractor conducted basic studies in several areas.

Studies of binary error rates at various pulse repetition rates were made and shown as a function of observed signal to noise ratio. Bit rates of 150 to 1500 bits per second were employed. These studies provided a basic method of measuring system reliability.

The radiation patterns of the corner reflector antennas were measured and found to be in close agreement with the theoretical pattern.

(*Continued on page* 11)



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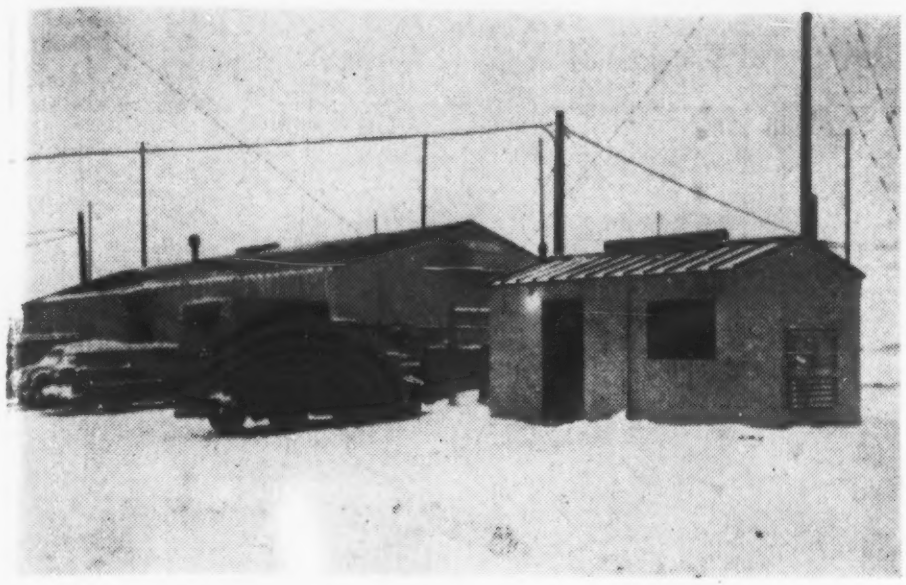


This circuit offered the first opportunity to evaluate the newly developed FSK-2 equipment. The use of the FSK-2 equipment on this circuit proved the equipment to be highly satisfactory.

A study was made using on-path and off-path antenna pattern orientations. This was to determine the relative signal contributions from both meteor reflection and scattering. It was observed that the signal received with the off-path orientation was greater than the on-path orientation during periods of low signal intensity and high meteor activity. This was especially noticeable during the early morning hours. The tests confirmed the value of additional investigations in this area.

The expected propagation reliability of approximately 99% for this circuit using 4-channel multiplex was confirmed. On 1 January 1956, the contractor turned this installation over to the Government for operational use by the Alaska Communications System.

Both telephone and teletypewriter traffic was handled during the period of operational employment.

Due to the rise in solar activity during 1956, long distance sky wave transmissions from Kenai caused serious interference to other services in California and it became necessary to silence the transmitter during most of the daylight hours.

When the transmitter could be operated, performance of the circuit continued to be highly satisfactory with only about a 1% outage due to propagation and a 2% outage due to other factors.

This interference problem could have been resolved by operation at a higher frequency. The change to a higher frequency was not practicable since it required complete antenna redesign and other extensive transmitter modification.

Operation at the higher frequencies tends to lower the reliability of the circuit due to a decrease in the signal strength as the frequency is increased. The higher frequencies avoid long-distance sky wave interference and lower frequencies provide higher signal levels.

The Juneau to Kenai ionospheric scatter system was a successful application of ionospheric scatter as a reliable means of communication. The expansion of other communications facilities in Alaska and an urgent need for this equipment elsewhere led to a decision to deactivate this circuit. This circuit was deactivated in October 1956.

I believe that now would be an appropriate time to discuss some of the equipment aspects of ionospheric scatter.

Transmitting Equipment

In order to satisfy stated military characteristics for radio transmitting equipment for scatter use, the U. S. Army Signal Engineering Laboratories are currently directing the development of Radio Transmitting Sets AN/FRT-32 and AN/FRT-34. These equipments are intended to provide maximum reliability and utility for military scatter application. The design and construction work has been undertaken by Continental Electronics Manufacturing Co. of Dallas, Texas.

The equipments are designed primarily for A3a and A3b emissions, with provision also for A-1, F-1 and F-3 emissions. There are three amplifiers which make up these transmitters. Power output capabilities are intended to be 32, 100, and 600 kilowatts peak envelope power for A3a and A3b emissions. We expect to run at 16, 50 and 300 kilowatts carrier power for A-1, F-1 and F-3. So, we generally refer to the three amplifiers involved as the 16 KW, 50 KW and 300 KW units.

Radio Transmitting Set AN/FRT-32 includes all amplifier units, while Radio Transmitting Set AN/FRT-34 includes only the so-called 16 KW and 50 KW units. The sixteen-kilowatt unit has no "set" nomenclature as yet.

The exciter unit employs circuits operating at relatively low frequencies for generation of the various types of modulated signals. These are multiplied or converted to a common frequency of 18 megacycles, where they are in turn converted to the output frequency by an internal crystal oscillator. Input connections are available for external excitation at 18 megacycles, or for variable frequency oscillator insertion in place of the crystal oscillator.

The sixteen-kilowatt amplifier is designed primarily as driver equipment for the higher powered amplifiers. It can be operated directly into antenna systems for emergency use, or for circuits requiring lesser amounts of power. The control system provides for operation of this equipment with either the 50 KW or the 300 KW amplifier as an integrated transmitter unit.

Single tubes, operating Class B for all services, are employed in each of the power amplifier stages.

The sixteen-kilowatt unit employs an Eimac 4X500A, driving an Eimac 4W20, 000A in grounded cathode circuits. It contains circuitry for both unbalanced and balanced output.

The 50-kilowatt stage employs a Machlett Type ML-5681 in a grounded grid circuit. The 300-kilowatt stage employs an RCA Type A-2332-D in a grounded cathode circuit. Both these stages use tank circuits consisting of capacity loaded lines.

Balanced output networks for each stage are contained in additional cabinets. The tube selection, operation and circuit configuration were chosen to minimize harmonics and spurious problems consistent with other requirements. The frequency range is covered in not more than three bands for any of the system components. Standing wave ratio and power output indicators are employed for all tuning functions.

Water and forced air cooling are employed for each equipment. Heat exchanger design is based on maximum temperature and altitude likely to be encountered. Because of this consideration the 50 KW and the 300 KW heat exchangers are each divided into two sections. It is expected that only one section for each amplifier will be required for adequate cooling in most installations. The exchangers may be located some distance from the transmitters if necessary. For locations having adequate natural water supplies, a water to water exchanger of much smaller dimensions can be supplied, eliminating all radiators and their cooling fans.

Automatic regulation of all tube voltages and extremely low impedance power supplies have been employed. Plate supplies are three-phase full wave rectifiers. The 300 KW stage employs two such supplies operating in series because of limitations on the peak inverse ratings of the rectifier tubes at high temperature ambients.

Transformers and filter inductors are capable of outside installation except under extreme arctic temperatures. "Electronic crowbar" circuits are provided for protection of the 50 KW and 300 KW tubes against damage due to internal arc back. Key interlock systems coupled to grounding arms on all high voltage circuits are provided. Fault locating systems are included in the control circuitry. Primary distribution and control are contained in cabinets rather than the usual wall switch gear.

The use of ceramic insulation has been avoided wherever possible to minimize the necessity for disassembly of the major components of the equipment for shipment.

A 300-kilowatt dummy load is available for test purposes if required; however, this is not included as part of the equipment. RF switching, water de-ionizing equipment and provision for intake and exhaust of cooling air are considered part of the station installation; likewise, these are not included with the transmitters.

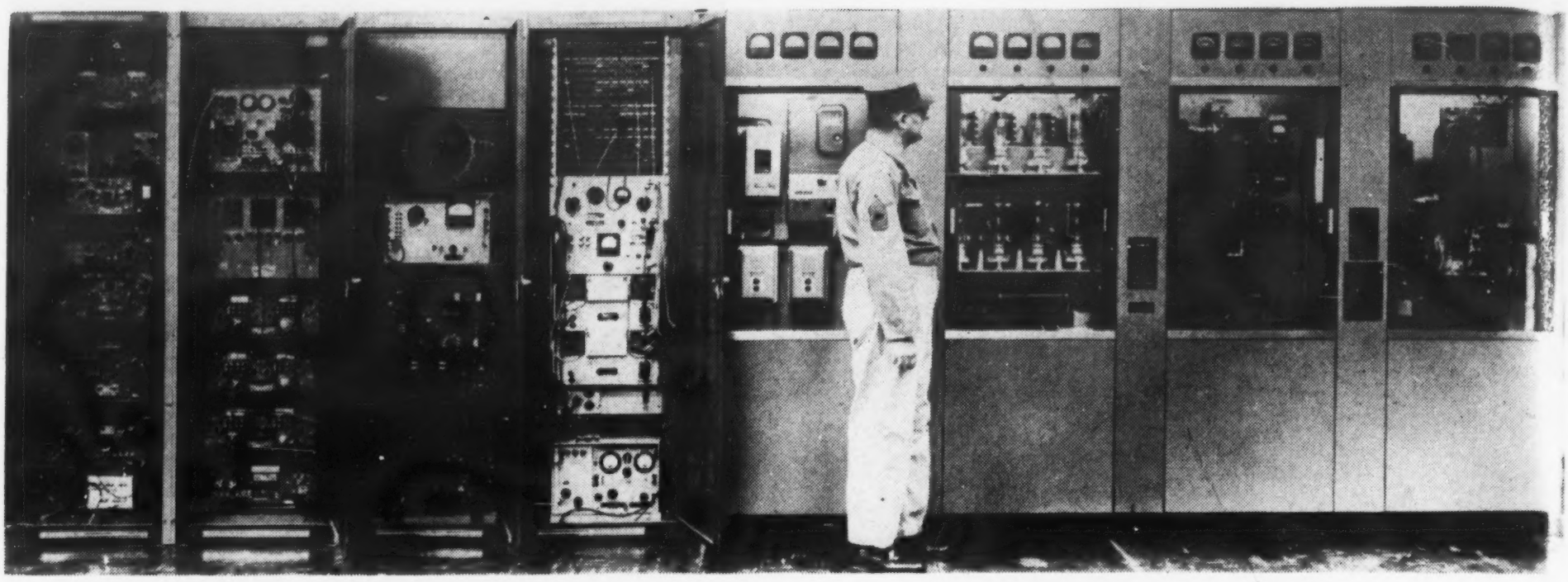
It is expected that the completion of this development will provide all the Military Services a series of radio transmitters which will meet their requirements for use in scatter propagation in the VHF range.

The Army has recognized the potentialities of tropospheric scatter in meeting certain Army fixed plant operational needs. In 1953 it was decided to establish a tropospheric scatter circuit on a quasi-experimental basis using off-the-shelf equipment if possible. This circuit would be used as a testing facility to evaluate the performance of various assemblages of equipment and to gather empirical data on long term circuit reliability.

A study was made of available Signal Corps equipments to determine those which could be used on tropospheric scatter circuits. It was determined that with the exception of high powered RF amplifiers and suitable antennas, useable components were available in the Signal Corps Supply System.

After suitable studies, a circuit between Woodbridge, Virginia, and Ft. Monroe, Virginia, was selected as an appropriate path for establishing the experimental circuit. The path length of approximately 145 miles was considered adequate to reveal the capabilities and limitations of a system made up of available equipment.

A contract for the installation of this system was awarded to RCA. RCA modified the buildings, supplied the 10 KW amplifiers and the parabolic antennas, installed the Signal Corps furnished equipment, tested the system and turned the operating installation over to the Army in May of 1955.



The terminal equipment is comprised of the following:

A cabinet which contains Telephone Terminals AN/TCC-3 and Telephone Carrier Terminals AN/TCC-7;

A second cabinet which contains the AN/TRC-24 Transmitters and Telephone Carrier Terminals AN/TCC-7;

A third containing test equipment and the AN/TRC-24 receivers;

Fourth cabinet containing more test equipment and the VF Ringing equipment, and 4 additional cabinets containing the 10 KW amplifier (See photo above).

The antennas are parabolic dishes 28 feet in diameter, constructed of perforated aluminum and weighing 1100 pounds. (See photo below).

Test operations were conducted by the Army for a year. Considerable data was gathered on equipment reliability, median signal strength, rate of occurrence of telegraph errors and reliability of telephone channels.

An analysis of this data revealed that the circuit did not provide the year round reliability needed for Army fixed communications. During the summer months the circuit performance was highly satisfactory. During the winter months the circuit was not satisfactory a large percentage of the time.

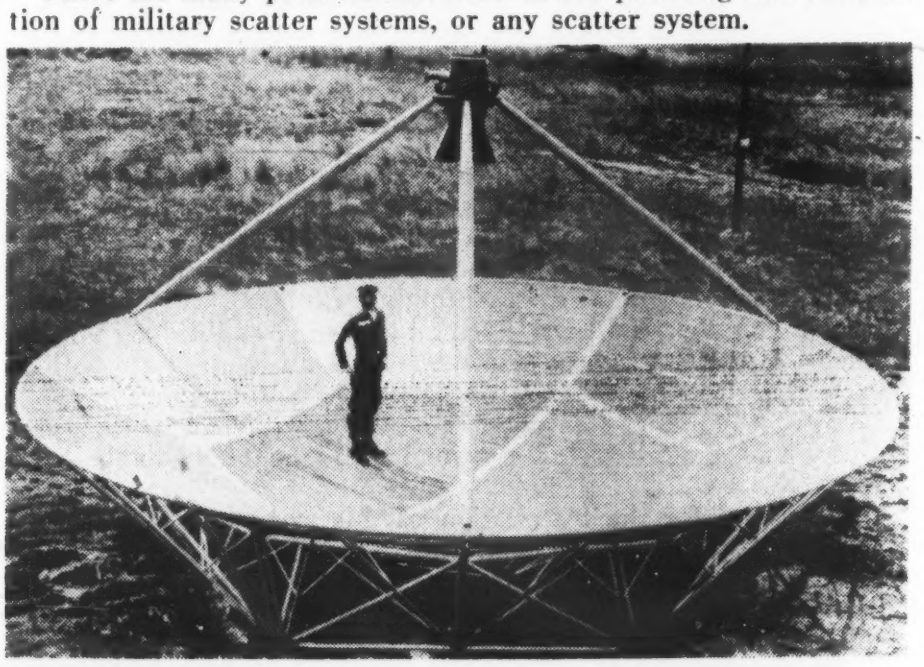
It was determined that several steps could be taken to improve the operation during the winter months. The receivers could be improved for this mode of operation by providing low noise preamplifiers and narrow bandwidth IF amplifiers. Diversity reception could be used to provide additional improvements. Our calculations indicated that with these changes the circuit could be expected to provide the required reliability on a year round basis.

At the present time the terminals are maintained in a stand-by status, pending modifications. It is expected that the improvements will be completed by August 1957, at which time the evaluation of circuit performance will be resumed.

After a period of successful performance the circuit will be employed for operational traffic. The experience gained in this effort will be used as the basis for future Army fixed-plant installation of this type.

With regard to our future plans for other scatter circuits, I can say that we are planning on a scatter system in the Western Pacific, which will supplement some of the existing HF radio circuits.

There are many problems involved in the planning and installation of military scatter systems, or any scatter system.



The selection of routes is often dictated by the availability of suitable relay points. Selection of these relay points and terminals requires a consideration of many factors. I will mention only some of the factors which must be considered in their selection:

The station function or mission.
Geographical factors.
Present land occupancy and ownership.
Siting criteria for the equipment.
Horizon clearances.
The climate and atmospheric conditions.
Availability of power and utilities.
Access roads and bridges.
Local communications.
Local transportation.
Local population, its language, its customs and its economy.
Civic development.
Availability of Government facilities, if any.
Subsistence and quarters.
Recreational facilities.
Medical and dental facilities.
Office facilities.
Shipping and warehousing facilities.
Availability of construction materials and equipment.
Availability of subcontractors.
Legal requirements.
Banking and financing facilities.
Local hiring problems.
Security requirements.
Air hazard conditions.
Other radio facilities in the area.
Communications center inter-connections.
Availability of petroleum, oil and lubricants.
Postal service.
The morale of the operators.

A Look at the Future

Recent experiments conducted by the U. S. Army Signal Engineering Laboratories in conjunction with Lincoln Laboratory have successfully demonstrated communications over a path in excess of 1900 miles utilizing a frequency well above the predicted maximum useable frequency for that path. Signal reliability was exceptionally good. This appears to offer a new and useful extension in range of scatter communication when it is realized that optimum performance of ionospheric E-layer scatter is 600-1400 miles. Before we become too enthusiastic, I must point out that a large amount of radiated power is required and the circuit is subject to considerable multipath distortion. Tests will be continued and it is hoped that good reliability may be experienced.

If we look into our crystal ball, I am confident we can see the Army Signal Corps continuing in its historic mission of communications. But in the scene we see, have the scatter modes taken a position of pre-eminence in the radio field, or are they found among the noble experiments of our day? We believe neither. Rather, we see the particular advantages of these techniques understood and being used—but not without the problems they still present in that future day—and we see them as having taken their due place among other modes and media of communication in the Army Signal Corps. With the frontier of the useful radio spectrum being pushed upward, we see also the new and now unsuspected discoveries of a future day, the equivalent of the scatter modes today, and I think I see a panel such as this discussing their pro's and con's. I wish I could stay to ask them some questions, but this concludes my presentation. (*Continued page* 20)

Maj. Gen. R. P. Hollis, USA
Commandant

The Industrial College of the Armed Forces

CIVILIAN-MILITARY TEAM EDUCATION

☆ ☆ ☆ ☆

Much has been written about the Civilian-Military Team concept from an industrial or military viewpoint. During the next decade, it is safe to say that much more will be written. Precisely so during this age of the Second Industrial Revolution when technological progress in our time is strengthening the cornerstone of our national security.

But, very few are privileged to write from experience about the industrial-military team concept from an educational viewpoint. The establishment of a curriculum to bring about the development of an industrial-military team for a postgraduate course is indeed a unique accomplishment. This is especially so, when the curriculum must be designed to prepare students to recognize problems in the interrelationships of economic factors with the political, military and psychological aspect of national security, and to determine the issues involved in these interrelationships, evaluate and relate facts, and reach considered conclusions.

The curriculum of the Industrial College of the Armed Forces is designed to do just this and much more. When one stops to think that our national security—in fact, our survival as a Nation—depends on the best efforts of the civilian-military team, we must admire the Industrial College of the Armed Forces for its dedication to the achievement of a better understanding, closer cooperation, and smoother functioning of this concept. The civilian-military team can function effectively only if all members of the team know the problems they are to face, know each others problems, capabilities and limitations.

To achieve this happy situation, the Industrial College, operating under the Joint Chiefs of Staff, conducts three courses—all closely related—but of different types and lengths, to fit the students' time and availability. They are the Resident Course, the National Resources Conferences, and the Correspondence Study Courses.

The major effort of the College is devoted to a ten-months resident course, conducted at Fort McNair in the heart of the Nation's Capital. The responsibility for managing this highest military college of learning falls on the shoulders of Major General Robert P. Hollis. As Commandant, he is doing a commendable job and deserves special recognition for his management and executive ability.

Recently he stated, "In wartime, we realize that we must be prepared to mobilize in support of the Armed Forces, not only the manufacturing, service and extractive industries, but all the productive resources of the nation, including the great private enterprise system which gives drive, direction and effectiveness to these productive resources. It has become increasingly essential that military men have an understanding of how our economic system is organized and run, what makes it tick, and what are the obstructions and hazards which lower its efficiency and output."

It is remarkable to think of a college established in the Military with a ten-months resident course, and incidentally, the only college of its kind in the world, to study such subjects as economics, government, business administration, public finance, and embracing raw materials, manpower, procurement, production, industrial services, implications of nuclear warfare, and other related economic subjects on the national and international level. At the Industrial College, these are some of the subjects which form the core of the curriculum.

Each year the resident course is attended by approximately 145 students. The students come from all Military Services, and 25 students are civilians from the executive agencies of the Federal Government. Admission is based on selection. Only those who have demonstrated outstanding proficiency over a period of years and have a potential for general or flag officer rank are recommended for attendance. Instructor guidance and direction is provided by a matchless combination of highly trained civilian professors and military educators. Backing up the Commandant and to insure modernism is a Board of Advisers (all top flight), representing various fields of industry, education and military. One of the major accomplishments of the resident course is the forward step toward integration, coordination and cooperation among the Defense agencies. This is brought about by the intermingling of civilian and service personnel in committee or seminar groups to develop facts relating to important problems effecting our national security. Another very active phase of the resident course is the study connected with economic and military potential of other nations, including the Soviet Bloc, and their capability to wage war, either hot or cold, with or against the United States. And, largely, the resident course as a whole enables the students to evaluate intelligently the

(*Continued on page* 18)

automation

IN THE

U. S. S. R.

by W. H. Brandt

Manager of Engineering
Director, Systems Department
Westinghouse Electric Corp.

AUTOMATION IS THE USE OF machines instead of men, to do jobs that the machines do better. Under such a definition, automation is a rather good measure of industrial progress in a country. From this rather broad viewpoint, this article will consider automation in the Soviet Union.

In Russia, since everything is owned or controlled by the government, it is possible to draw up a giant organization chart covering virtually all activities in the country. The part of this chart with which we are particularly interested concerns the Industrial Ministries, the Development Laboratories, the Research Laboratories, and the Educational System (Figure 1). During my visit to the U.S.S.R., our host was the Ministry of Machine Tool and Instrument Manufacture which controls all machine tool plants in the Soviet Union. We visited the Ordzhonikidze Machine Tool Plant and the Red Proletariat Machine Tool Plant. The Institute of Machine Tools reports to this Ministry and does development work for the entire industry. Reporting to the Institute is an experimental machine tool plant that may be thought of as a pilot plant serving the entire industry. At the same level as the Industrial Ministry on our chart, is the Academy of Sciences which operates Research Institutes. The two we visited were the Institute of Precision Mechanics and Calculating Technology and the Institute of Automechanics and Telemechanics. Actually, it would be equally proper to place the Academy of Sciences at a level above the Industrial Ministry with a dotted-line relationship to the Council of Ministries. The Academy of Sciences plays a considerable part in determining policy in the Soviet Union through its influence on the Council of Ministers.

The Ministry of Higher Education is on the same level as the Industrial Ministry and controls the colleges and universities.

The picture then is an organization in which a policy on automation may be put into effect in the Council of Ministers, carried out in the factories, in development laboratories, the research laboratories and in the educational system. Operationally speaking, this is the major difference between the Soviet system and our own. There are some important strengths inherent in this system, but there are serious weaknesses as well.

Men engaged in the engineering profession are very well off in the Soviet Union, but there is an ascending scale of prestige within the profession itself that ascends roughly from left to right on our chart. At the bottom are engineers in industry; at the top are college professors.

Points of interest which were observed in the Soviet Union will be discussed in the reverse order, starting first with the educational system. Figure 2 is a picture taken on the campus of the University of Moscow to give some idea of the size of the building and some idea of its architecture. The point here is that the Russians are sparing no expense in building up their educational system. This building is the finest building in the Soviet Union. The cost of plant and buildings in this area alone was about three billion rubles, equivalent to 750 million dollars based on exchange rate, or about 300 million dollars based on purchasing power.[1] I doubt if any single American university can boast an equal expenditure.

An expensive building, of course, is no measure of quality of a university. We visited the Physics Laboratories and found them over-crowded, but the equipment was good. They have a program of expansion aimed at alleviating the over-crowded conditions. Equally impressive are the

[1]Dr. Norman P. Auborn, "Russia's 'New Look' in Higher Education," *The Akron Alumnus*, Winter 1956.

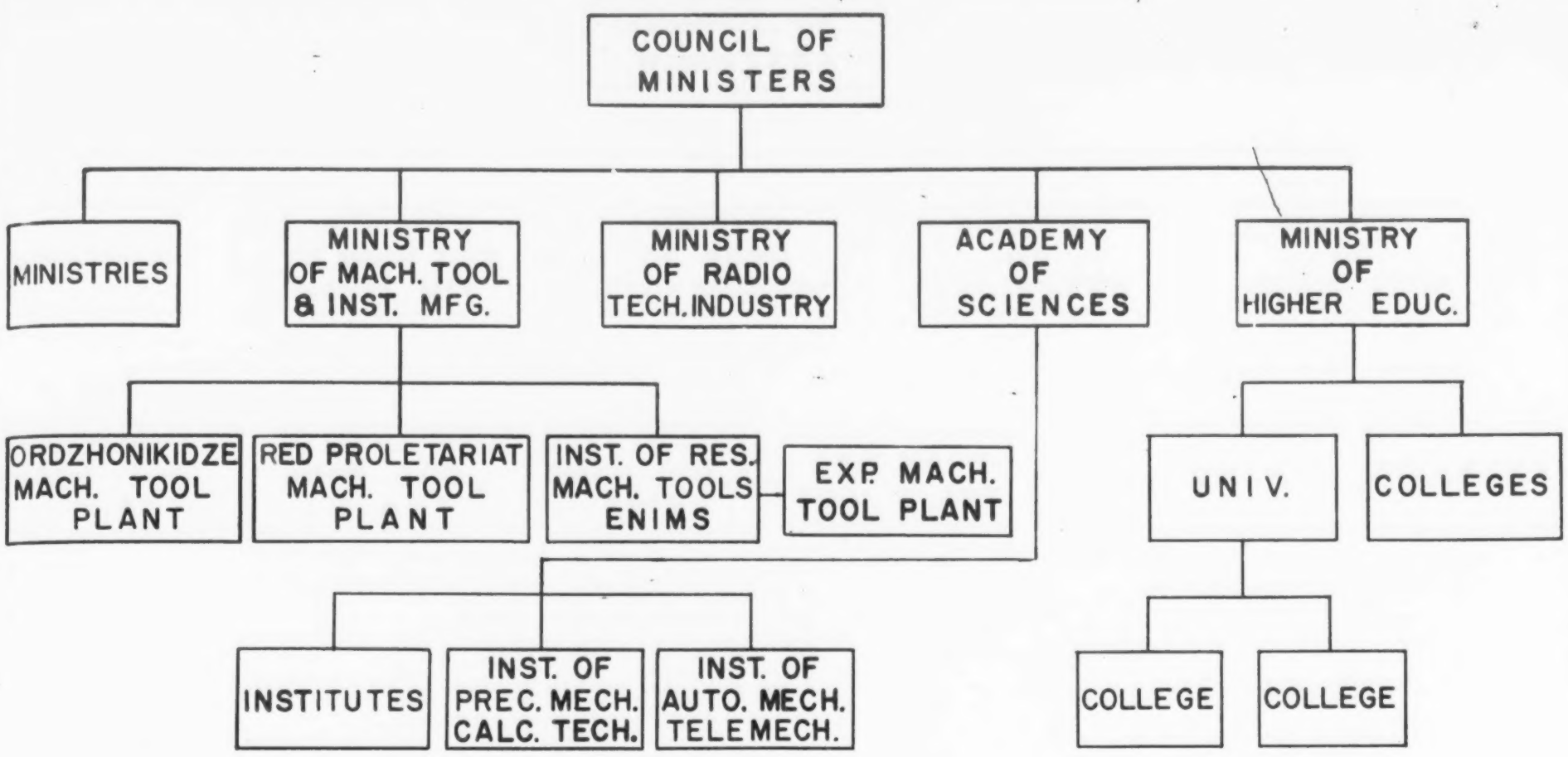


Figure 1

salaries paid by the educational system. The average engineer employed in industry made about 1400 rubles per month in December 1955. The college professor made 5500 rubles per month, approximately four times the average pay of engineers in industry. For comparison, the average worker makes about 100 rubles per month. The exchange rate is four rubles to the dollar, but purchasing power is nearer 10 or 12 rubles to the dollar.

The University of Moscow is not an engineering school. We did not have time to visit the Engineering School. We did not obtain figures on engineers trained in the Soviet Union, but there are figures available indicating that they are training about twice as many engineers as we are. However, half of the students at the University of Moscow are trained in technical subjects such as mathematics, physics and chemistry, and such figures as I have found indicate that training in these fields runs roughly in the same ratio. We saw good work going on in the research laboratories and in fields related to automation. At the Institute of Precision Mechanics and Calculating Technology, an opportunity was afforded to see the Russian BESM computer, used entirely in solution of scientific problems such as reduction of data for contour mapping and computation of tables of integrals. It is something like an IBM 701 or IBM 704, but is claimed to have some advantages. It contains 5000 tubes and four types of memories. It seems to make good use of these memories and has very efficient print-out devices. It is down 20% of the time for maintenance; 8% of the time is charged to error losses, leaving an effective operating time of 72%. This is a pretty good figure for a first model of a computer.

The significance of computers in automation, of course, is that the time is coming when such computers will be used to control large sections of our factories, and perhaps entire factories. When that time arrives, the Russians are showing the necessary technical know-how, at least.

The Institute of Automechanics and Telemechanics would be called a servo and telemetering laboratory in this country. At this laboratory, they work on basic problems in these fields, starting chiefly from the theoretical viewpoint. Laboratory equipment is usually built to prove a point of theory. The analog computer shown in Figure 3 is used in solving servo equations up to the 6th order, linear or non-linear. They demonstrated it on 3rd order equations, and were able to set up such an equation and get the solution in about five minutes. The answer appears on a large scope which is at the left of the console, not shown in the picture. It is a compact computer and very convenient to use. It would be incorrect to say that they are ahead of us in automation research but they are doing good work. In some places, they come pretty close.

At the Institute of Machine Tools, they operate a pilot plant and it was impressive to see the machines with which they work. Shown in Figure 4 is a large two-spindle hydraulic fol-

Figure 2

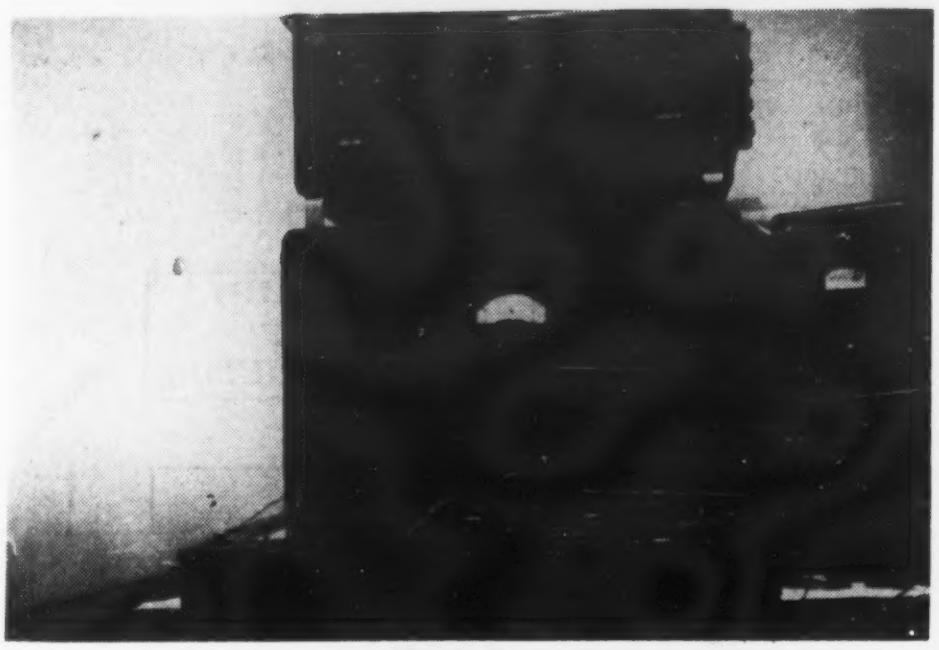


Figure 3

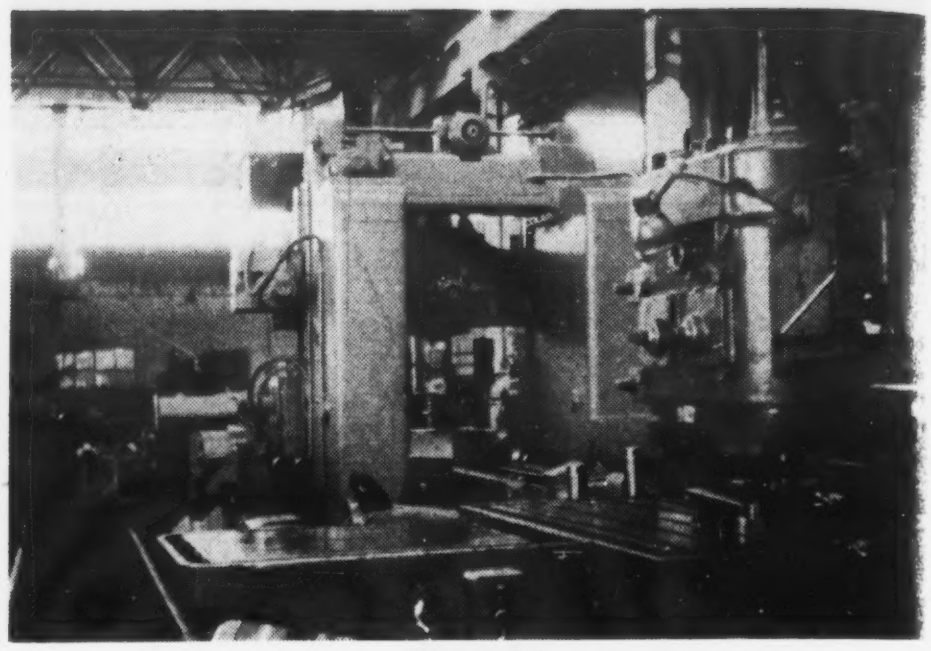


Figure 4

lower machine similar to a Hydrotel with a large planer to be seen in the background. A balancing machine was under development which takes the rotor of an electric motor, spins it, measures unbalance and position in magnitude, and then removes automatically the right amount of metal to put the rotor in balance. When we saw it, it required an operator, but it was very clear from its design that it is intended to fit into an automatic line and to operate without human attention.

At this Institute, they not only design individual automatic machines, but they design complete lines of automated equipment to do a specific manufacturing job. Their outstanding achievement and the high-water mark of Soviet automation is the automatic bearing line at the Kaganovich State Ball Bearing Plant No. 1 in Moscow. At the beginning of the line are two hoppers (Figure 5)—one for inner bearing races, one for outer bearing races. Rough forgings are placed in these hoppers and are conveyed then to the large lathes. There is an assembly operation on the line, a gauging station, and a packaging machine connected with a belt conveyor.

When we saw this line in operation, we saw one actual operator with at least 10 or 12 maintenance men. We were not sure if further operators were not normally required but temporarily absent from their stations during the visit. In a recent article, it is reported that this line is now operating without a single operator.[2]

It is the writer's opinion that we would be very proud of this automatic line if we had it in this country. It is certain that in designing and building it, the Russians have shown ability to provide automation in their factories of a very high level.

In this same factory, most of their production is done with old equipment. Only a small portion of their productive capacity in that plant is represented by this automatic line. However, where they have automation, it can be very good.

At the Red Proletariat Machine Tool plant, there was an assembly line for lathes in operation with a capacity of 54 lathes per day (Figure 6). I know of no assembly line in America that can operate at that capacity. We did feel, however, that the Russians used many general purpose machine tools where special purpose machine tools are used here. We therefore infer that they have over-standardized machine tools to permit them to manufacture on assembly lines such as this. This is certainly costing them efficiency in the plants using this equipment. Assembly line runs away from the observer almost at the center of the picture; sub-assemblies are made in an aisle to the right and are moved over to the line with monorail hoists.

In the factory—such as automobile factories—working conditions, housekeeping, etc. vary from rather good on the final assembly lines to rather poor in the area where they manufacture parts. The assembly line for the Pobyetta at the Gorki Plant moves in counter-clockwise fashion with the cars mounted on stands in the overhead position. Lighting is good; cleanliness is good; and the line is very orderly. However, if you look at the picture (Figure 7), you will note that there is only one workman present and no evidence of material moving to the line. This gave the distinct impression that the operation of the line was "staged" for our benefit.

[2]Peter Trippe, "Russia's 'Automatic Factory'," *American Machinist*, January 14, 1957.

Figure 5

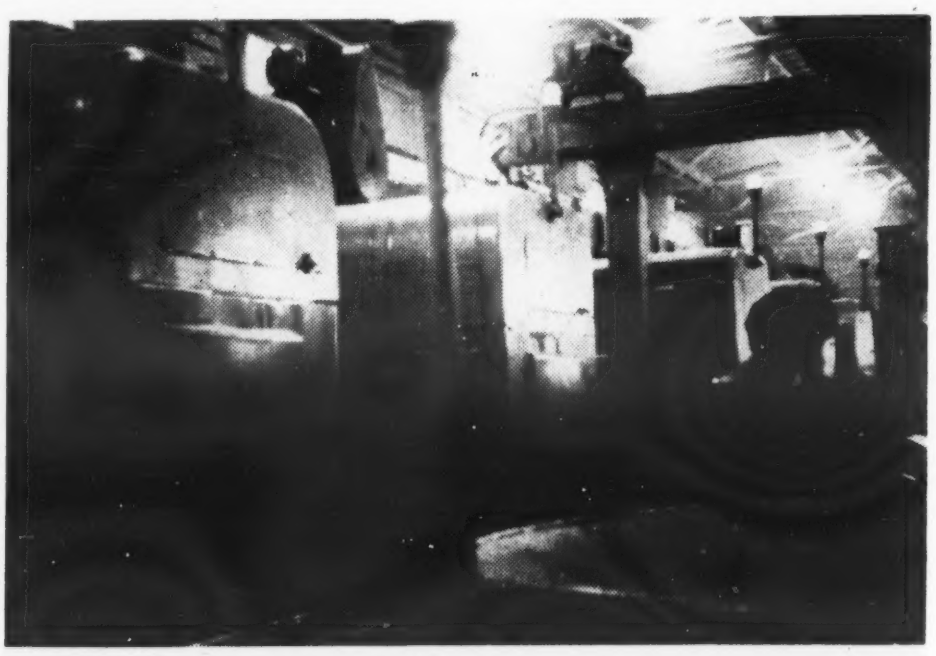


Figure 6

Figure 7

Figure 8

On the punch press line, you will note (Figure 8) rather large clumsy tote boxes used for materials handling. At the far right are hand trucks used for the same purpose. The picture carries its own evidence that heating, lighting and cleanliness are rather poor. We saw many conditions in Russian factories that were poorer than this, but this was about the poorest condition under which we could get a reasonably good picture with available light.

I have told you that automation, where they have it, can be very good, but that it represents a small part of their productive capacity. What is the comparative productivity of a Russian and American plant of the same type? *Our team estimated that the average Russian plant was less than one-half as productive as a corresponding American plant.* It happens that in the Gorki Plant, figures were made available to us that permitted a rough check of productivity. The Pobyetta car, we were told, sells for 20,000 rubles. The average Russian worker makes 1000 rubles per month. It, therefore, takes 20 months' salary to buy a Pobyetta. The average American worker can buy one of the three low-priced cars for six to seven months' work, and this ratio is about 3 to 1, taking no account of the fact that the American automobile is far superior. It seems fair to state then that the productivity of a Russian automobile plant is about one-third that of a corresponding American plant, and it is the writer's estimate that this probably applies to other plants that we saw.

In Stalingrad, there was a crowd gathered in front of a department store; they heard that there were rugs for sale in the store. The crowd gathered to get some of the rugs before they were all gone. Consumer goods are scarce in the Soviet Union; prices are high, and their standard of living is poorer than our standard of living was in the worst days of World War II.

The Russians are putting tremendous effort into their educational system, they are doing good work on automation, in the research laboratories, and the development laboratories, and while one sees relatively little automation in the non-military factories, what automation they have is good. It is the writer's opinion that under the Russian system, problems large enough to be given consideration by the Moscow planners are solved, and are solved well. It is not felt that this system will be able to catch up with America for years—if ever—in providing a high standard of living for its people. There are too many small problems that do not get solved at all.

However, it must be remembered that we saw no military plants; it was notable that the Russians were making large numbers of good machine tools, but that few of these machine tools were seen in the automobile and tractor plants. One infers that many of these new machine tools are going into plants for the production of military items.

In producing for the military, the Russians have several advantages under their monolithic organization. All military production must be planned and they are used to planning. Secondly, because they do not have a high standard of living, the Russians are able to devote a large share of their productive capacity to military production. This is reason enough why we should not be complacent about our ability to out-perform the Russians in production for the military.

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Civilian-Military Team
(*Continued from page* 13)

economic, political, military, psychological, and industrial aspects of mobilization problems. Yes, the students must learn to solve future military problems without placing insurmountable burdens on the national economy.

Besides the ten-months resident course, the Industrial College sponsors two extension courses, the National Resources Conferences and the Correspondence Study Course. The National Resources Conference is a condensed version of the resident course. It is presented each year in sixteen cities covering the major industrial population centers of the Nation. The course runs for a period of two weeks. To date, courses have been presented in approximately 100 cities, covering 29 subjects and received by 38,000 officers and civilians.

The Correspondence Study Course is also based on the resident curriculum and is conducted for qualified individuals who cannot attend the resident course, as well as graduates of the National Resources Conference. Both of these courses are designed and conducted for selected industrial executives, educators, writers, representatives of labor, religion, medicine, and agriculture (to mention a few) and other prominent citizens, also officers of the National Guard, inactive Reserves of the Army, Navy, Air Force and Marines. The purpose of the two extension courses is to expand the nucleus of informed individuals who may be called upon to help formulate policy in the management of our country's economy during peace time or an emergency.

Today, more than at any time in our history, we must face up to the challenges which confront us in this changing age, an age of technological progress, social and industrial revolution. In these post-war years, the more thoughtful citizens, the more responsible members of the business community have become increasingly aware of the fact that war is no longer the monopoly of the military. Security is everybody's business and the facts are needed.

It is my unshakable conviction that the members of the Armed Forces Communications and Electronics Association and their friends will get the facts and enjoy a refreshing experience if they attend at least one of the National Resources Conference lecture courses which will be given in the following cities during 1957-1958.

Burlington, Vt.	23 Sep – 4 Oct 57
Sioux Falls, S. D.	23 Sep – 4 Oct 57
St. Louis, Mo.	21 Oct – 1 Nov 57
Boise, Idaho	21 Oct – 1 Nov 57
Pittsburgh, Pa.	11 Nov – 22 Nov 57
Memphis, Tenn.	2 Dec – 13 Dec 57
Fresno, Calif.	13 Jan – 24 Jan 58
Indianapolis, Ind.	13 Jan – 24 Jan 58
Los Angeles, Calif.	10 Feb – 21 Feb 58
Boston, Mass.	10 Feb – 21 Feb 58
Charleston, W. Va.	17 Mar–28 Mar 58
Philadelphia, Pa.	17Mar–28 Mar 58
Rochester, N. Y.	14 Apr – 25 Apr 58
Fort Worth, Tex.	14 Apr – 25 Apr 58
Montgomery, Ala.	12 May–23 May 58
Bridgeport, Conn.	12 May–23 May 58

The College serves not merely to ameliorate the spirit of cooperation among the Services, but is unequaled within the military educational system in that it serves to foster understanding and appreciation by the military of the problems of industry. How significant this contribution is may be measured by a quotation from the President of the United States, made at the time he was commanding SHAPE. He said.

"The strength that a nation or a group of nations can develop is the product obtained by multiplying its spiritual or moral strength by its economic strength, by its military strength. It is the product, not the sum; consequently, if any one of these factors falls to zero, the whole is zero. There can be no army unless there is a productive strength with a productive power to support it. There can be neither a strong economy nor an army if the people are spiritless, if they don't prize what they are defending."

To sum up the accomplishments of the Industrial College is a little hard to do. I know of no yardstick to measure the results. The best I can do is to tell you that due to their efforts, this year alone, about 6,000 people are more interested in national defense. They have a better understanding of the problems that must be solved and the price we must pay to ensure the survival of the American way of life.

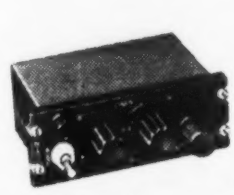
Since a virile and healthy economy is a requisite for a strong defense, it follows that military action to ensure our national security must not impair our economic strength. The complex and interrelated problems of building our military strength without reducing our economic strength is the special field of study of the Industrial College. Its motto, "Industria et Defensio Inseparabiles," symbolizes the College's importance. Through education, the civilian-military team is truly inseparable.

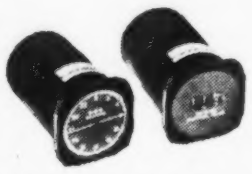
The Editor

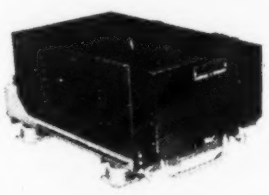
Exciting new things are happening at

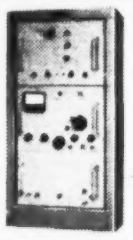
HOFFMAN ELECTRONICS

TACAN is the most advanced aircraft navigation system yet developed . . . and Hoffman makes the complete airborne portion of the TACAN-VORTAC systems. Hoffman has also developed the highly efficient HLI-103 Beacon Simulator to bench-test airborne equipment for TACAN-VORTAC UNITS. Other navigation equipment under development at Hoffman includes long range airborne radar direction finding and automatic dead reckoning systems.


Cockpit control panel


TACAN-VORTAC distance and azimuth indicators


Airborne TACAN-VORTAC Receiver/Transmitter


TACAN-VORTAC Beacon Simulator

In research, development and production in the science of military and commercial electronics, exciting things continue to happen at Hoffman.

PHYSICISTS • ELECTRONICS AND ELECTRO-MECHANICAL ENGINEERS

Significant new developments at Hoffman in the fields of navigation, VLF, HF, VHF, UHF, radar, ECM, weapons systems and semiconductors have created important positions for scientists and engineers of high calibre. Please address inquiries to Chief Engineer.

Hoffman Electronics

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3761 South Hill Street
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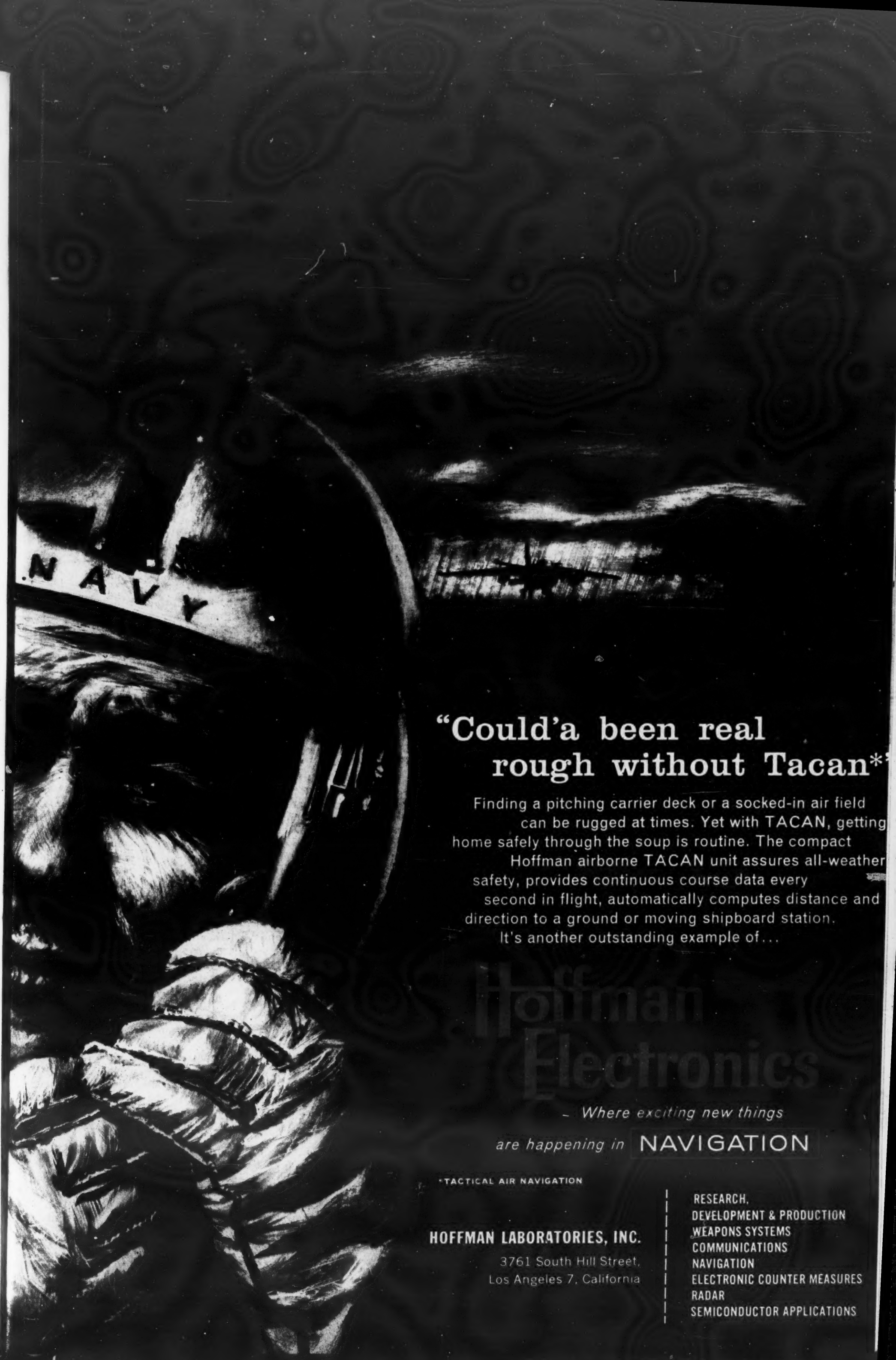

"Could'a been real rough without Tacan*"

Finding a pitching carrier deck or a socked-in air field can be rugged at times. Yet with TACAN, getting home safely through the soup is routine. The compact Hoffman airborne TACAN unit assures all-weather safety, provides continuous course data every second in flight, automatically computes distance and direction to a ground or moving shipboard station. It's another outstanding example of...

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– Where exciting new things are happening in NAVIGATION

*TACTICAL AIR NAVIGATION

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RESEARCH,
DEVELOPMENT & PRODUCTION
WEAPONS SYSTEMS
COMMUNICATIONS
NAVIGATION
ELECTRONIC COUNTER MEASURES
RADAR
SEMICONDUCTOR APPLICATIONS

(*Continued from page* 12)

The next speaker is Captain W. A. Ellis, U. S. Navy, Head of Future Plans and Policy Branch of the Office of The Director Naval Communications.

U. S. Navy Presentation

One of the major objectives of the Naval Communications Improvement Program is the exploration of new phenomena and the exploitation of new techniques. To this extent the Navy is naturally interested in the possible application of any and all modes of radio propagation which will facilitate the accomplishment of the Navy's role at sea.

My colleagues of the Air Force and Army will tell you much regarding the application of the scatter technique to the long haul point-to-point circuit. The Navy's interest in this respect is equal, and we are cooperating fully in the development of the Navy's portion of the Joint Ionospheric Scatter System to be installed in accordance with the world-wide plan formulated by the Joint Communications-Electronics Committee of the Joint Chiefs of Staff. This effort will include the establishment of a system across the North Atlantic Ocean area between the United States and the United Kingdom, and another system in the North Pacific Ocean area running between the United States and the Aleutian Island Chain. At the present time the Navy is still engaged in the site survey phase of these two projects. However, it is contemplated that these systems will be in operation between Fiscal Years 1962 and 1965.

As you can well appreciate, the Navy's first interest is the sea and the ships which are charged with the responsibility of maintaining our supremacy on the seas. Thus, it is only natural that our foremost hopes for scatter lie primarily in its possible application to the communications of our forces afloat—both for tactical and ship-shore linkages. Therefore, to preclude being repetitious, it is the purpose of the Navy presentation to give you a brief look at what our investigations over an all-seawater path have revealed, rather than to dwell further on the point-to-point application. Hence, my discussion will be confined to tropospheric forward scatter and another form of scatter known as meteor burst, the two modes of radio propagation which presently show the most promise for ship-to-shore and ship-to-ship communications.

Most of the work and the resulting scientific and engineering data obtained on forward propagation by tropospheric scatter has been obtained between fixed points with all over-land or mixed over-water and land paths. Based upon this information only a "guesstimate" could be made regarding the feasibility of its use over an all-water path. Hence, in 1953 and 1954, the Naval Research Laboratory commenced a series of preliminary investigations in the Chesapeake Bay area. The results obtained from these very limited tests were so significantly promising as to indicate the desirabilty of further and more extensive exploration.

The middle of calendar year 1955 marked the beginning of experiments using a Naval vessel as the receiving end of an all over-water transmission link with the transmitting facility located on the coast.

The transmitting facilities used for these tests were located at the Lincoln Laboratories, Round Hill, Massachusetts, site. The shipboard receiving facilities were installed aboard the *USS Achernar* (AKA-53) and later aboard the *USS Thuban* (AKA-19).

The Round Hill transmitter was operated on CW and voice using 10 KW and 40 KW UHF transmitters and high gain dish antennas.

The shipboard receiving installations consisted of modified, WW II vintage, steerable, high gain paraboloid radar antennas with accompanying pedestal mounts and controls, sensitive receivers and signal level recorders.

In the tests the ships involved steamed in and out on fixed bearings from the shore transmitting stations, while continuous recordings were made of the received signal levels.

The transmissions from Round Hill were periodically modulated (narrow-band FM) by voice and music samples previously magnetic tape recorded. The received transmissions were tape recorded aboard ship. Excellent quality recordings were consistently obtained at distances out to about 300 miles. Beyond 300 miles, deep fading of the signal caused some short period outages, but in general the quality remained excellent.

Frequent two-way voice communications were also conducted between the ships and Round Hill, using an AN/TRC-24 FM transmitter aboard ship at 80 watts transmitter power into the modified radar antenna. Good results were obtained out to about 250 miles. On one of the test days a two-way circuit was set up between the Naval Research Laboratory and the ship using commercial telephone line between NRL and Round Hill, and a two-way scatter circuit between Round Hill and the ship. For a period of approximately one hour very successful two-way communication was maintained between personnel aboard ship and at NRL. At this time the ship was approximately 200 nautical miles from Round Hill.

The quality of reception during these tests was relatively good even under the fading conditions out at the maximum range. It would appear, therefore, that there is little or no difference in the tropospheric scatter mode, whether its path be over-land or all over-water. To us in the Navy, this is most encouraging.

As previously mentioned, the Navy is also interested in the possibilities of another form of the scattering technique, viz., the field of meteor burst or meteor trail communications. I regret that for this discussion I do not have any visual aids or recordings to relieve you of the monotony of my voice. Therefore, I beg your indulgence for the next few moments while I tell you briefly something of the results of the Navy's investigations in this area.

Investigation for Naval application was initiated at the Navy Electronics Laboratory, San Diego, California, in June 1955. This work is being accomplished in cooperation with the Stanford Research Institute of Stanford University, Palo Alto, California. Actual tests were begun in July 1955 with the monitoring at San Diego of a Stanford transmitter on 43.5 MCS. In order to point toward the eventual desired utilization of this mode of transmission in ship/shore and ship/ship communication circuits, meteor burst signals from the Stanford transmitter were later monitored by a Navy ship off the coast of Southern California in November 1956. Like the early tropospheric tests, results were promising and an experimental communications link is being set up at the present time between the laboratory and Stanford in which bursts of time-compressed teletype information will be transmitted from NEL, received at Stanford, and automatically retransmitted to NEL during the presence of suitable meteor trails.

In this experimental link transmitters with an expected output power of about 1 KW and relatively low gain, low directivity antennas are being used. Frequency shift keying (FSK) modulation is used to transmit teletypewriter information which is first recorded on magnetic tape at 60 words per minute, then reproduced for transmission at 4800 words per minute, an 80 to 1 compression ratio. In operation, the transmitters and receivers at both locations remain on continuously. The reception at NEL of a sufficiently strong meteor echo of the NEL signal, retransmitted by Stanford, indicates the formation of a closed loop which starts the information transmission at NEL. The decay of the meteor echo to a critical amplitude, causes the transmission of information to cease.

As previously noted, the Navy studies and experiments in the fields of tropospheric scatter and meteor burst communications are pointed toward the use of these modes in Naval shipboard communication applications. However, the use of such modes aboard ship introduces many difficult problems yet to be solved. The most obvious, perhaps, is the antenna problem. A high gain antenna is of significant size and weight. In addition, it must remain accurately oriented on its shipboard platform which rolls, pitches and yaws at the mercy of the sea and changes of course. Nevertheless, tropospheric scatter terminals appear feasible for shipboard installation from the standpoint of weight and size since a relatively high gain antenna at the ultra high frequencies is within reason and not significantly larger than some of the radar antennas now carried aboard our ships. On the other hand, antenna orientation on the mobile platform of a ship is not as difficult as it might seem. For a number of years many of our ships have had stable elements on board for stabilizing fire control devices and automatically compensating for roll and pitch in gun positioning. Servo information from the ship's gyro compass, fed into the antenna azimuth control mechanism, can correct for yaw and course changes, and automatic tracking also can be provided, so that once the antenna has been positioned and is receiving the signal, the signal itself can be used to keep the antenna pointed into it.

Another problem in the use of the scatter modes in a mobile environment is that of the high transmitter power required. This is an aspect which makes meteor burst communications appear attractive for shipboard use. However, in the meteor burst technique, a more difficult antenna orientation problem may be presented because of the automatic tracking element that enters the problem.

These are only a few of the problems that confront the Navy development effort today. As in the past we are confident all obstacles will be hurdled; the ingenuity and inquisitiveness of our engineers and scientists will triumph. Application of these new techniques to shipboard use is not just around the corner, but as the state of the art progresses, it is our fervent hope that scatter will provide us with the capacity, reliability, range and speed we desire in our modern communications and our data transmission systems.

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	COMPUTER AND CONTROL ENGINEERING	MISSILE GUIDANCE ENGINEERING

ELECTRICAL AND ELECTRONIC ENGINEERS with 2 or more years experience in:	• Gyro Development
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	• Fire Control Systems
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	  ◦ Transmitters
	  ◦ Pulse Circuits
	• Digital Computers and Data Processing
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		• Military Specifications
		• Electronic Circuitry
		• Magnetic and Transistor Amplifiers
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		• AC and DC Servo Motors
		• Electronic Research
		• Missile Control Systems

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Lunivac

by

Christopher James

ON THE OCCASION OF THIS writing, I would prefer to restrict my readers to that small but exclusive percentage of AFCEA members who are truly intellectuals.

Not that I am against that great majority of non-intellectuals of which I am a member, but rather, to conserve manpower, why waste important peoples' time unnecessarily, when by appealing to the intellectuals alone, I can reduce the total manpower loss to a very small figure.

How do I define an AFCEA intellectual? Easy—here are the premises:

(1) Men and women are equally intelligent, differing only in shape and number.

(2) Even more important, women and men members are equally stupid; in fact, more so, or vice versa.

(3) Most AFCEA members can read—(one can't write).

(4) Now mathematically, if

X = readers' dollar annual income (earned, but not necessarily deserved)

Y = age

Z = mental agility—i.e. $\frac{X}{Y}$ (approx.) or more exactly $Z = \frac{2\ Xmax}{Ymax} \cos^2 \theta \left(\frac{x}{\lambda} - ft\right)$

We quickly grasp from this familiar equation, with the usual connotations, that the average value of Z throughout a life-time is obtained from the fact that the average of the cosine square is ½. Therefore, if you are still reading this and want to be an average square-headed cosine, you can consider yourself as a half-wit and have qualified to write a letter, if also an optimist, to the Editor of SIGNAL asking for a refund on your national dues, and you need read no further.

Now that my reader-audience has become more chummy, and we are a small group, let me pose the questions to which we dedicate this loss of printer's ink—to wit and/or to wits, if you prefer:

(1) Who reads all the scientific reports being generated today?

(2) Do the authors read as many as they write—or should they?

(3) Could the paper industry survive if the military and its contractors worked 10% more and wrote 10% less?

(4) And, finally, how can the poor guy doing research ever find out what the true state of the art is, or again, more properly, why should he?

Our problem thus, generally centers about the relative importance of the status of literature and particularly rules for determining:

(1) What is the state of the art Unclassified?

(2) Is there a state of the art Confidential?

(3) Is there a state of the art Secret?

(4) Is there a state of the art Top Secret?

(5) What is NATO doing?

(6) How about Intelligence Data?

(7) What is the state of the art as described by our publicity offices or sales departments?

Easy, say I—and here comes my invention.* I call it the LUNIVAC; it is worse than human, it is lunivistic!

Of course, I use transistors; in fact, I use solid state MASERS and even now am working on an improvement using the new Yttrium garnet solid state microwave amplifier, working at room temperature instead of that Iadolium** stuff requiring liquid helium temperatures. And memory devices—I have built in more memory than a wife who thinks her husband is untrue; more memory than a collector of internal revenue; in brief, memory like a guy from whom you borrowed five bucks last year.

(*Continued on page* 24)

*If Pravda wishes to claim first rights to this invention, they can have it with my compliments.

**My stenographer misspelled this word, but it makes better sense her way.

"This refers to yours of the 10th..."

Some people still hammer out communications one character at a time.

Others use DATAFAX—the fast Stewart-Warner electronic way to transmit all data over standard telephone lines.

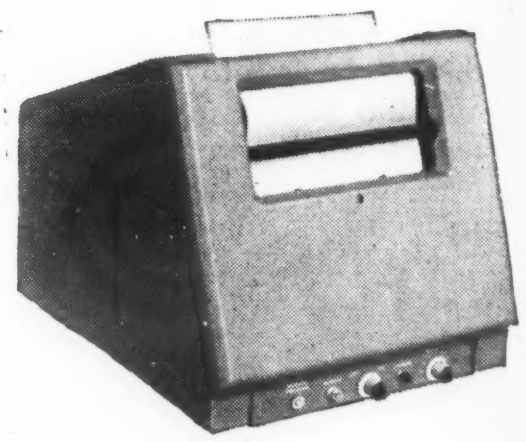
Datafax transmits and records any material: correspondence, drawings, pictures, printed matter, even handwritten notes. And since copies are exact duplicate images of the original, chance for error is fully eliminated.

Cost?

Automatic transmission and recording eliminate need for full-time operator; recorders will even respond to transmissions sent after the office is closed for the day. Datafax also eliminates retyping, proofreading, intermediate handling, intransit delays—and their clerical costs. The clear, smudge-proof, permanent Datafax copy costs less than 2¢ for a letter-sized unit, plus pro rata line charge.

Chances are your operations have outgrown Stone Age Communications. If so, you'll want to find out about Datafax.

First, send for your copy of the free Datafax bulletin. Write: Stewart-Warner Electronics, Dept. 15, 1300 No. Kostner Ave., Chicago 51, Illinois.



STEWART SW WARNER **ELECTRONICS**

a Division of Stewart-Warner Corporation

Colossal, I say!

Now, here is my idea—

Through use of magnetic tapes, the awful facts of most anything can be recorded—even in triplicate! Supporting this potential: The ferrites permit a distorted one-way transmittal of information (often desirable); the MASER permits great stabilization of information (a new phenomenon); improved condensers allow lots to be stored in little. (preferably if condensation occurs without precipitation); transistors provide the means for easily passing everything through a slug of germanium for rectification which is undoubtedly a good idea; and as for free radicals. . . . they should be put in equipment marked clearly "for export only!"

So why not?

I mean, why not take the substance of *all* our scientific findings and store them on a gigantic metallic magnetic sheet which can be played up and down, back and forth, and even in criss-cross directions, introducing harmonic relationships as necessary, combining cross-correlation techniques in accordance with the strict rules of *Information Theory* and the *Second Law of Thermodynamics*, so that we arrive at an equipment potential giving in consonance with *Cybernetics*:

(1) The entire state of the art.

(2) Individual outputs giving abstracts of all information in accordance with clearance and the "need-to-know" of all inquisitors.

(3) Electroencephalographic coupling between scientist and machine to determine "ability-to-know." This will require a ruggedized heavy-duty device.***

(4) An output signal which could tell the engineer that he needs more academic training before the machine can understand his questions, i.e., "ability-to-interrogate." This is the most delicate part of our apparata.

(5) An output signal which could tell the engineer-scientist that he should change jobs and look for a higher salary because of the cleverness of his questions. (Undoubtedly, this reaction would soon lead to the well-known "tilt" in pin ball machine phenomena.) Page 22.

Such a machine would be relatively simple and cheap to construct (like a 4th of July rocket compared to an ICBM). Manpower would be no problem at all, since first, we could draw on that tremendous reserve of technical manpower always playing musical chairs and for which a month or two of delay between jobs would really harm nothing but would actually add more experience, giving them a chance to ask for even more money; second, we could ask that much smaller group now permanently established (Hmmm . . . ?) to devote their prolonged coffee breaks to thoughts along lunivistic lines, instead of—well, you know; and third, there are hundreds of industrial outfits who, although they are still feverishly advertising for new personnel, are running out of work and would be glad to assist in such a noble endeavor (if the charge can be placed elsewhere than on electrons).

***See Specification "Infantry versus Tank" USA-MIL-7734.

So what are we waiting for?

Just around the corner from ASTIA is this wonderful LUNIVAC. A truly complete Technical Documents Center in a flashy console, and as auxiliary equipment, a beautiful female attendant continuously serving people deficient in information and/or in social contacts.

One of these much-in-demand scientists slouches in — complete with two days' beard and incomplete with necktie.

She says, "Clearance please, Doctor . . ." (assuming the Ph.D. because of his wild look and unshined shoes).

He says, "Confidential" and produces appropriate security documents.

She says, "Subject?"

He notes the tight sweater and, with considerable self-restraint, gets back to his secondary interest and says, "Atoms," (though thinking of Eves.)

Then the miracle happens!

A few buttons are pressed — the LUNIVAC goes into rapid motion, and the breeze felt is caused by cards falling into a large receptacle giving abstracts of all information known on ATOMS, carrying no higher classification than "Confidential."

Delighted, the young scientist and six assistants pick up the cards and move with their loot to a secluded corner for several months of perusal (most contracts allow six months for these studies). Efficient always, and not wishing to lose contact with either the operator or the machine, the young scientist periodically plays for new material. But, oh — by some new miracle directive, declassification is going on so smoothly and rapidly, new material is being added to his reading list faster than he disposes of the old!

Alas, more invention is required—including, undoubtedly, a contract extension for the interrogator.

Easy, say I—let's write less! Or is that swapping sense for dollars?

But the paper and pencil lobby says "not so fast, gentlemen, we deserve a living too."

As I am about to make a remark, someone passes peanuts, and I am left stuck with the problem, so I look for a beer. . . .

Months after I submitted the first draft of this article to the good Editor of SIGNAL, I came up with a solution — admittedly a radical suggestion, but unbelievable in its simplicity. Here is the idea . . . !

But wait—how do I know I even have a reader?

BURIED IN "ELECTRICAL" IS NATION'S FIFTH LARGEST INDUSTRY

The world has changed a bit since Ben Franklin flew his kite and Edison invented the electric light. We have telephones, radio, television, automation, radar, sonar, computors, guided missiles, earth satellites and other wonders thanks to radio-electronics—now fifth largest industry in the nation.

If you are looking for facts and figures on this young Goliath in the *Standard Industrial Classifications*, they lie buried in "Electrical", code #36. It isn't easy to conceal an industry employing 1.5 million people with sales at 11.5 billion dollars annually. What will S.I.C. do when, within a decade, sales reach 22 billion dollars as radio-electronics continues to be the fastest growing of all U.S. industries?

Radio-electronics is big, basic and diversified. It is a business with more than 4,000 manufacturers and suppliers scattered over the length and breadth of our country. It already employs almost 100,000 of the nation's 500,000 engineers and needs more to create and manage its remarkable plants and factories.

Electronics has changed modern warfare and has become vital to defense. Electronics is changing commerce and industry. Electronics is influencing the lives of all of us and will change our living patterns and standards even more in the years to come.

Investors consider electronics as having a limitless future. Today, the field is served by a number of important business publications and a big professional Society. *The Institute of Radio Engineers* now has more than 50,000 engineer members as well as 10,000 student members.

By strictest definition, that which utilizes the movement of electrons is electronic. Back in the dot-and-dash era, electrical engineers reluctantly admitted that radio might have some limited value in ship-to-shore communication. Still in the dot-and-dash era, S.I.C. ignores radio-electronics' existence—even if it is the child that outgrew its parent . . for, by popular definition, electronics has come to mean *everything electrical.*

The next time the Federal Government and the Department of Commerce look over the 1700 *Standard Industrial Classifications,* may they examine code #36 more closely! A giant like radio-electronics can't be buried and expected to rest in peace. You can bet your bottom transistor on that.

THE INSTITUTE OF RADIO ENGINEERS

Proceedings of the IRE

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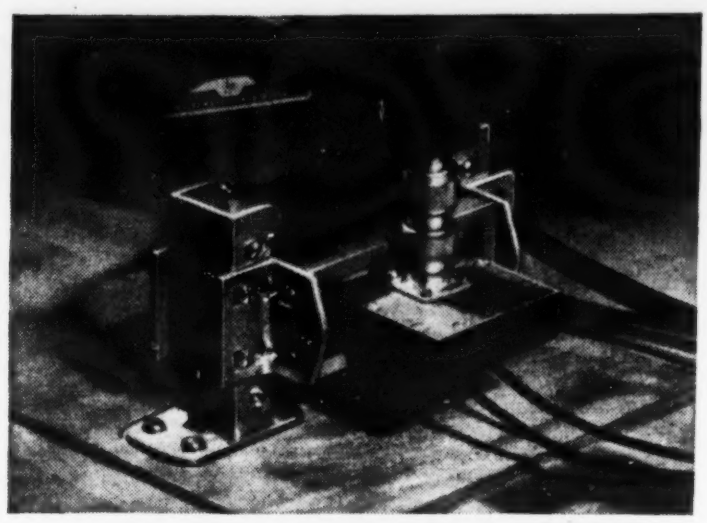
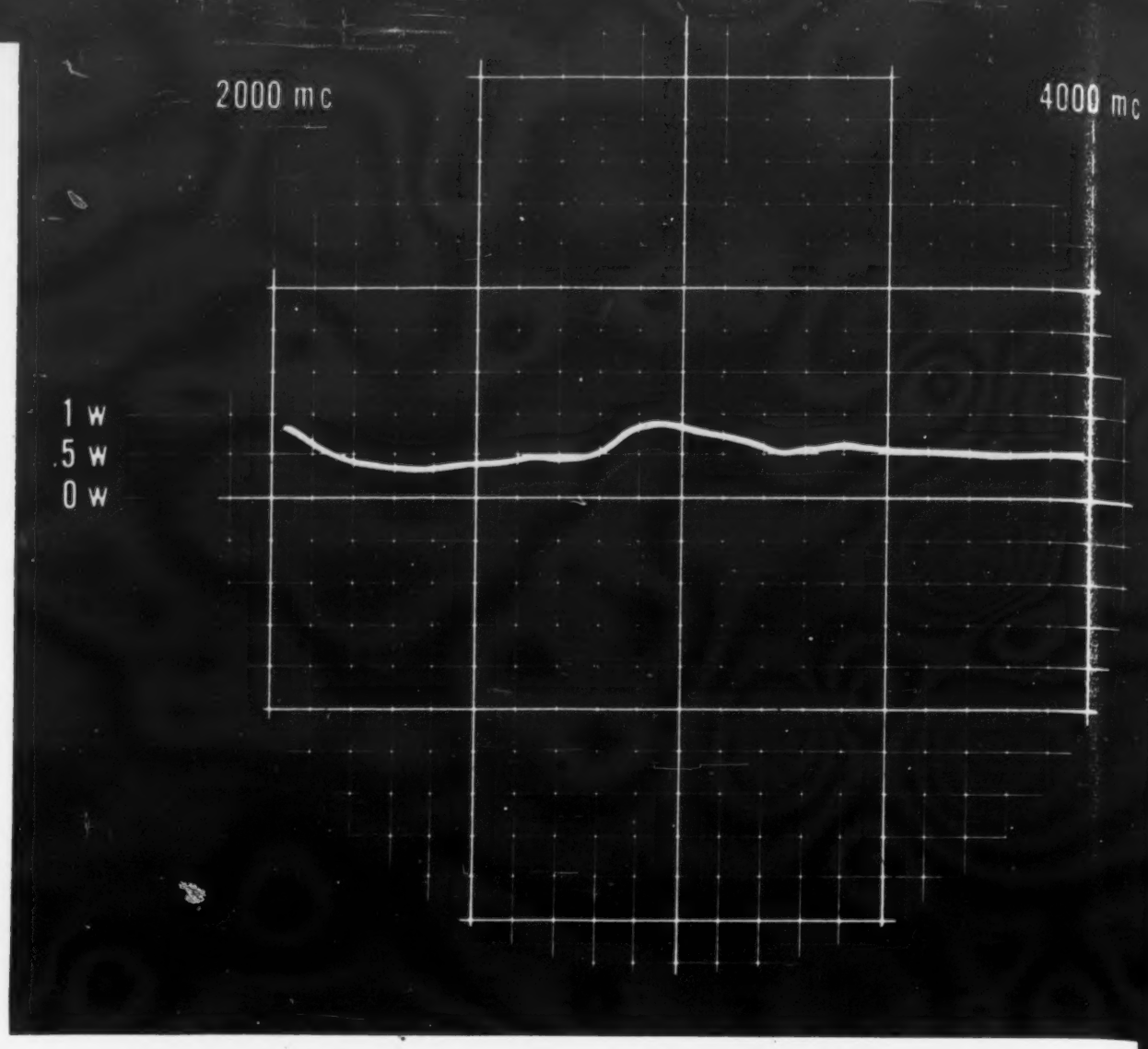
ABOVE: the GL-6917 voltage-tunable magnetron is extremely small and compact—only $\frac{5}{8}$" high and less than $\frac{3}{4}$" in diameter. **BELOW:** complete cavity and magnet assembly for the GL-6917 has been developed to assist equipment manufacturers.





▲ Observe from the scope presentation above (actual photograph made with a production GL-6917 on test) how power over the entire 2000-mc tuning range is substantially constant, varying only .5 w. Because tube frequency, with voltage-tunable magnetrons, is a linear function of anode voltage, an r-f signal can be tuned at will to any frequency in a wide spectrum.

New GL-6917 voltage-tunable magnetron combines wide-range tuning, steady output, dependability!

General Electric's GL-6917 voltage-tunable magnetron—first of a new series in development—offers to designers of military and other microwave equipment a simple, efficient means of changing output frequency rapidly with no important reduction in signal power.

The tube is a major breakthrough in circumventing enemy radar-jamming and in other counter-measure work. Also, the GL-6917 finds direct application in missile tracking and other telemetering . . . . . in air navigation . . . . . broadband test equipment . . . . microwave communications generally.

Construction is extra-rugged. Fundamentally compact and sturdy, the GL-6917 is a hard-solder type and is metal-ceramic for even greater strength. The tube is designed to operate unpressurized up to 60,000 feet altitude.

General Electric has developed a special cavity and magnet assembly for the GL-6917, to assist designers in applying the tube to equipment on the boards. For full information on Type GL-6917 and accessories, call your regional G-E power-tube representative! *Power Tube Department, General Electric Company, Schenectady 5, New York.*

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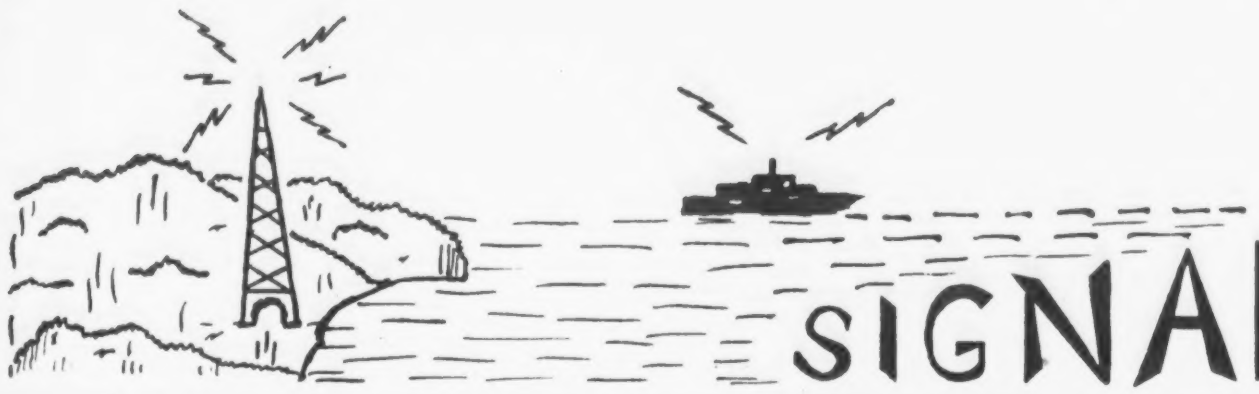
9545-8481-1



SIGNAL·GRAM

— GOVERNMENT —

DOERFER NEW FCC CHAIRMAN George C. McConnaughey resigned as chairman of the Federal Communications Commission in July. John C. Doerfer, a member of the Commission since 1953, has been appointed as the new chairman by the President. Mr. Doerfer is a former chairman of the Wisconsin Public Service Commission, a graduate of the University of Wisconsin and received a law degree from Marquette University.

"DEW" LINE IN THE PACIFIC The far-ranging radar picket planes have carried America's Distant Early Warning line 1,500 miles out across the Pacific. Recent activation of two WV-2 "flying sentry" squadrons at Barbers Point NAS, near Honolulu, extended the electronic net of ground and air stations, those already guarding northern and eastern approaches to the continent, westward to the mid-Pacific.

NAVY'S VLF STATION The world's most powerful and effective Very Low Frequency (VLF) radio station will be operating in Washington County, Maine, by 1961. The Navy uses VLF stations for shore-to-ship broadcasts, operating at around 15 to 20 kcs. The Maine transmitter may be rated as high as 2000 kw. A special antenna will be used for this installation which will be a cross between the new German type and Annapolis VLF.

U.S. TO LEASE SHIPS AND LANDING CRAFT TO CANADA According to the terms of a recent U.S.-Canadian Agreement, six ships of the Navy-operated Military Sea Transportation Service and twelve Army landing craft will remain in the North for ultimate leasing to Canada at the conclusion of the 1957 DEW line resupplying operations in the Arctic this summer. Thereafter, Canada's Northern Transportation Company, which now services U. S. electronic defense installations in the Mackenzie River area, will operate the ships in future seaborne resupply of the western Canadian sector of the DEW line.

SIGNAL SCHOOL ADDS THREE NEW COURSES The constantly expanding age of electronics has necessitated the addition of three new enlisted courses at the U.S. Army Signal School, Fort Monmouth, New Jersey. The courses are: Radio Wave Propagation Specialist, Ground Control Approach Equipment Repair, and Fixed Electronic Cryptographic Equipment Repair.

CONTRACT AWARDS: ARMY: Lewyt Manufacturing Corp., radio sets for combat vehicles, $4,210,468; Gilfillan Brothers, Co., engineering services for guided missile development, $1,056,345; Hazeltine Corp., radio beacons, $216,529; North Electric Co., switchboard equipment, $152,187; Western Electric Co., Inc., research and development on NIKE-ZEUS, $1,886,740; Stewart-Warner Corp., receiver transmitters, $1,483,311; Bomac Laboratories, Inc., magnetrons, $194,103. NAVY: Westinghouse Electric Corp., development and delivery of launching system for POLARIS, $10,000,000; Remington Rand, Division of Sperry Rand Corp., UNIVAC-LARC, $3,500,000; Raytheon Manufacturing Co., Sonar training equipment, $1,580,056; Collins Radio Co., radio equipment, $1,516,343; Ampex Corp., magnetic tape recorders, $104,685. AIR FORCE: General Electric Co., development work on nose cone for ATLAS and THOR, $158,000,000; Sperry Gyroscope Co., Division of Sperry Rand Corp., flight equipment for high-performance conditions, $1,298,518; Hoffman Laboratories, Inc., simulators and beacons, $1,056,000; Weston Electrical Instrument Corp., Instrument Landing System cross pointers, $1,212,586; Bendix Radio Division, Bendix Aviation Corp., development of radar set for air traffic control, $2,223,751; Avco Manufacturing Corp., TITAN nose cone development, $111,308,359. CAA: Stromberg-Carlson, a Division of General Dynamics Corp., 263 sets of tactical air navigation (TACAN) test monitor and control equipment, $10,000,000; Teletype Corp., teletypewriters, $3,688,680.

ARMY TESTS EQUIPMENT Heavy testing of the Army's ever-increasing electronic equipment used in its communications systems, missiles, and others began July 1. The program includes eight major field and command exercises. The largest exercise, "Gulf Stream," will last for 20 days in April 1958, at Fort Polk, La., in which some 26,000 troops will participate with training in the use of the ground-to-air guided missile, NIKE-HERCULES.

GENERAL QUESADA SUCCEEDS CURTIS AS AIR ADVISER Replacing The Honorable Edward P. Curtis, Lt. Gen. Elwood R. Quesada (USAF, Ret.) has been named special assistant to the President for aviation facilities planning. General Quesada, youngest retired Air Force general, is vice president of Lockheed's missile systems division.

FAR EAST FLU VIRUS The Department of Defense has issued policy guidance for military to be vaccinated as soon as possible with a special single-strain vaccine to combat a previously unidentified virus which has caused an outbreak of influenza in the Far East. Dr. Frank B. Berry, Assistant Secretary of Defense (Health and Medical), said that the vaccine also will be made available to civilian employees and military dependents on a voluntary basis at overseas stations.

ARMY CONSERVES TIME FOR ENGINEERS How to make the limited number of engineers go further is the object of a new plan being tested by the Army. The idea may also work in industry. Business administration graduates with little or no technical training are being hired for under $4,000 a year to free engineers from routine jobs. The assistants keep records, handle procurement, review publications, etc. This system is expected to conserve up to 50% of the engineers' time.

LOOKING FOR A QUICK $100 IN CASH? The READER'S DIGEST is inviting members of the Army to submit contributions for its well-known "Humor in Uniform" department. Contributions must be true, unpublished anecdotes based on service experience. They should be typewritten, double spaced, and not more than 300 words long. Contributions cannot be acknowledged or returned. Army AFCEA personnel should mail their anecdotes to Chief, Magazine and Book Branch, Office Chief of Information, Department of the Army, Washington 25, D.C., ATTENTION: Humor in Uniform Editor, READER'S DIGEST.

— INDUSTRY —

EUROPEAN PRIVATELY OWNED RESEARCH REACTOR Europe's first privately owned and operated nuclear research reactor will be designed and built by AMF Atomica, a division of American Machine & Foundry Company. SORIN (Societa Ricerche Impianti Nucleari), jointly owned by the Italian industrial groups, Fiat and Montecatini, awarded the contract for the one megawatt pool-type reactor. The reactor will be used for nuclear research and development, production of radio isotopes, and training of personnel.

N.B.C. DONATES TV ENTERTAINMENT TO DEFENSE DEPARTMENT More than 450 hours of new programming for use on the 23 Armed Forces television stations at U.S. outposts abroad has been donated to the Department of Defense by the National Broadcasting Company. This is the largest single bloc of programs ever made available by any network or other program source for the entertainment of U.S. servicemen around the world. A salute to N.B.C. for their morale boost for our servicemen!

IGY AND THE ELECTRONICS INDUSTRY The electronics industry has done an outstanding job in providing electronic equipment for use during the International Geophysical Year which began July 1. On the monetary line, educated guesses approximated that about 20 to 25 per cent of the $30 million spent thus far on the project went for electronics in some form, which would total about $7 million being divided by electronic firms furnishing the equipment.

ELECTRONIC STENOGRAPHER FOR "LARC" Stromberg-Carlson, a Division of General Dynamics Corporation, has contracted to provide a 24 hour a day "electronic stenographer" to work with an advanced electronic computer created by Remington Rand Univac, a Division of Sperry Rand Corporation. The computer is designated the LARC (Livermore Automatic Research Computer). The "stenographer" will be a CHARACTRON computer readout, being able to display and record on film split-second "thoughts" of the LARC computer at the rate of 15,000 characters per second, amounting to 180,000 words a minute—50 per cent faster than any computer readout previously built by the company.

TV HELPS THE WELDER In watching structural spotwelding on the underside of large aluminum panels of the KC-135 jet tanker-transport skins, a closed-circuit television has replaced the human eye at Ryan Aeronautical Company, San Diego, Calif. A small General Precision Laboratory TV camera stares untiringly at the condition of both top and bottom welds with electronic accuracy and clarity and transmits a magnified report via coaxial cable to a 17" monitor screen at the side of the welder.

A FIRST IN GEORGIA The nation's first state-sponsored educational closed-circuit television system will be installed this summer by the Radio Corporation of America for the Georgia Department of Education in The Conley Hills Elementary School, Fulton County. The RCA educational TV system will serve primarily as a "laboratory" installation for Georgia educators who are studying the practicability of statewide teaching-by-television.

— GENERAL —

STOCK TICKER NOW SERVES ALL 48 STATES With the addition of Wyoming in June, New York Stock Exchange quotations began reaching ticker subscribers in all 48 states for the first time. This 20,000 mile ticker network flashes quotations from the New York Stock Exchange to 2564 stock tickers in 457 cities and towns in the United States, Canada and Cuba.

AERIAL COLOR PHOTOS REVEAL MINERALS Aerial color photography is now being used to make high-altitude portraits of mountainous and jungle regions in South America according to Hycon Aerial Surveys, Inc. Bird's eye pictures of earth structure in remote mountainous regions are giving geologists direct clues to mineral deposits which would have taken years to find on foot. Map-makers are also aided in the tedious task of mapping the earth's surface accurately in various regions of the United States as well as South America.

TV TRAINS IN ENGLAND After two years of experimenting, the British Railways have arrived with the first journey of a permanently installed TV train. Programs were transmitted to the train-turned-TV-studio through a 10 h.p. diesel generator in an adjoining car which generated 6 KW A.C. (250 volts) for all sound and vision. The train must be traveling at about 60 m.p.h. for a true TV picture on wheels.

SORTING MAIL AUTOMATICALLY An electronic mail sorting system is under development by the Canadian Post Office in Ottawa. Operators in special reading stations convert the address into a special code suitable for electronic handling, mark the code on the envelope with a special keyboard, and the remaining operations are completed automatically by high-speed electronic sorting equipment.

SLIDE RULE FOR SIGHTLESS STUDENT A uniquely designed slide rule has been presented as a gift for a blind engineering student by Keuffel & Esser Company, New Jersey instrument manufacturer. This unusual instrument employs tactile symbols in the form of raised brads systematically arranged and hammered into a 20-inch regular log duplex decitrig slide rule. It enables the user to handle the more complicated mathematics needed in electrical engineering.

THE MARKET AND NAMES FOR ELECTRONIC BRAINS According to National Securities and Research Corporation, the potential market for electronic computers is well over $5 billion and may prove to be closer to $10 billion, per annum. Foreign companies join the electronic brains industry listing with such names as: "Bark" and "Besk," Sweden; "G-1," "G-3" and "Informatik," Germany; "Mark II" and "Mark III," Japan; "Gamma," France; "Ural," Russia; "Leo," "Pegasus" and "Mercury," Britain; "Petra" and "Zebra," Holland.

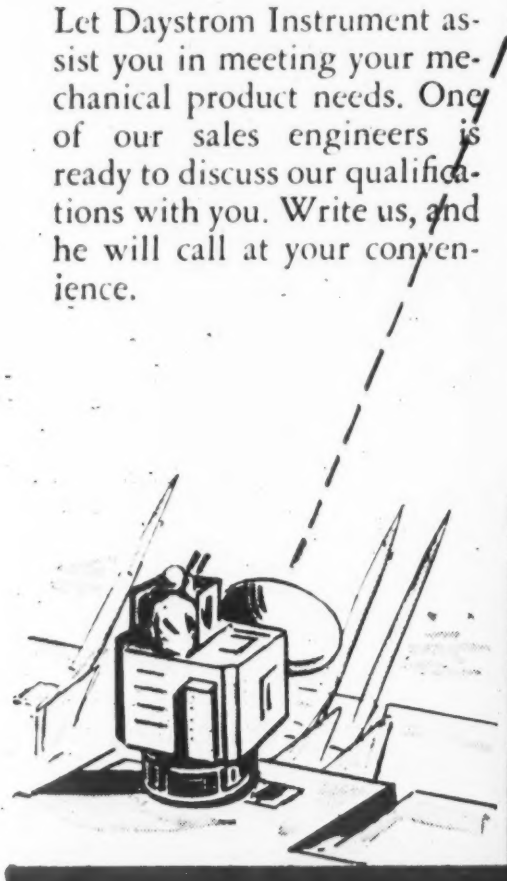
WESCON The 1957 Western Electronic Show and Convention will be held in the San Francisco Cow Palace August 20-23, and will include 765 exhibit booths, 225 technical papers at 48 sessions. Maj. Gen. Bernard A. Schriever, Commanding General of the Air Force Ballistic Missile Division of the Air Research and Development Command, will be the principal speaker at the all-industry luncheon on August 23.

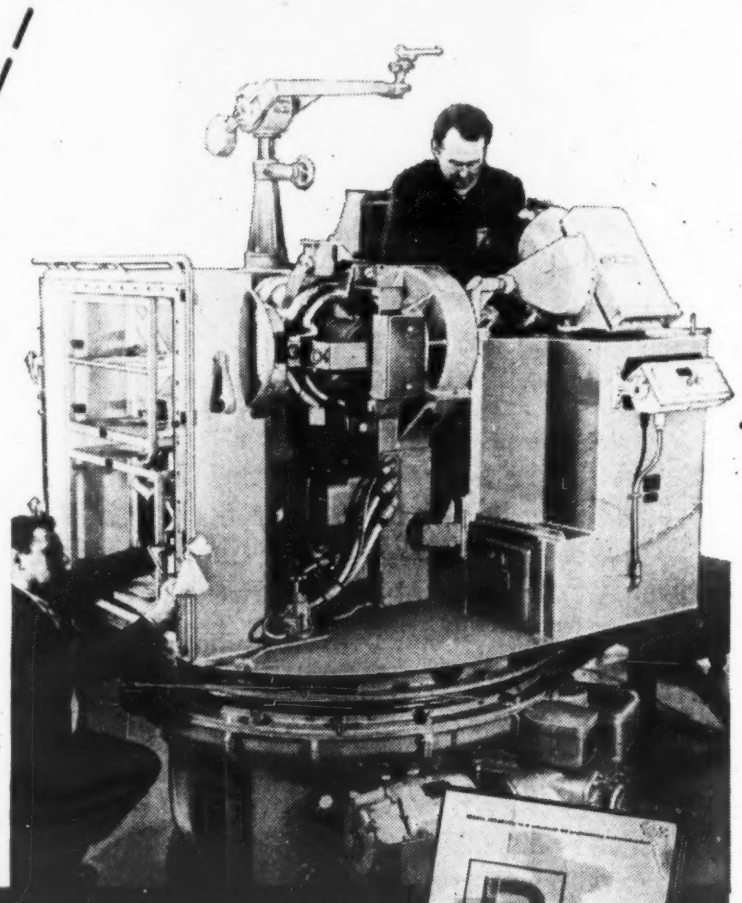
Mechanical Assembly

High quality MECHANICAL ASSEMBLIES are shipped to satisfied customers every day from Daystrom Instrument.

The close tolerance work of our machine shop is transferred to mechanical assembly. In our modern 350,000 sq. ft. plant we can handle a wide range of precision mechanical assemblies on a production-line basis.

Let Daystrom Instrument assist you in meeting your mechanical product needs. One of our sales engineers is ready to discuss our qualifications with you. Write us, and he will call at your convenience.





DAYSTROM INSTRUMENT

Archbald, Pennsylvania

Visit Our Booth No. 315 At Wescon—Aug. 20-23

LETTERS to the Editor

DEAR SIR:

In regard to the article on "Value Engineering" which appeared in the June issue of SIGNAL, we recently received the following letter from the Renegotiation Board (addressed to RAdm. R. L. Swart, USN, Vice Chief of Naval Material), which expresses its policy on the treatment of value engineering incentive earnings. It is our opinion that the policy will result in equitable treatment if the contractor properly documents his value engineering earnings to the Renegotiation Board.

Sincerely yours,
J. M. WATERS
Director of Value Engineering
Bureau of Ships
Department of the Navy

DEAR ADMIRAL SWART:

. . . The Board is pleased to be informed of this important development in your procurement techniques and of its modus operandi. While I think it is obvious that the Board cannot commit itself in advance to the specific treatment to be given in any individual case (since in overall renegotiation many factors prescribed by the renegotiation statute must be considered), we nevertheless recommend the specific action suggested below.

We suggest that the Navy ask its contractors having contracts of this type to inform us of that fact in renegotiation proceedings, and to be prepared to describe and document their value engineering accomplishments thereunder. This will enable us to explore the matter fully in each individual case, obtaining from the Navy pertinent facts and opinions through the performance reporting procedures already established between our agencies.

Having developed the facts in each case, all due consideration will be given thereto under the statutory factors in the determination of the case. As you know, the factors in the law are quite comprehensive and enable the Board to give suitable recognition to any achievements of this type on the part of defense contractors.

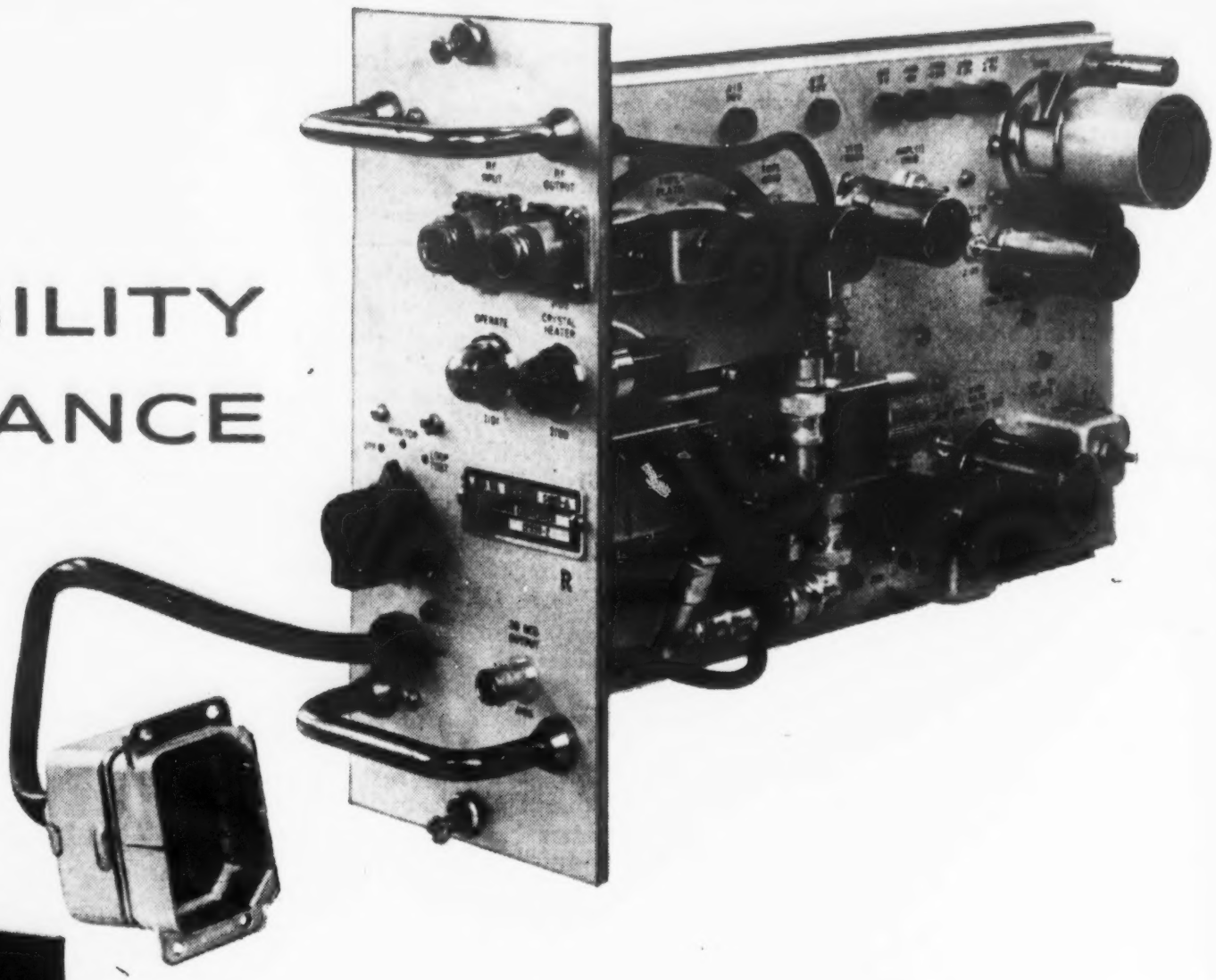
Sincerely yours,
THOMAS COGGESHALL
Chairman
The Renegotiation Board

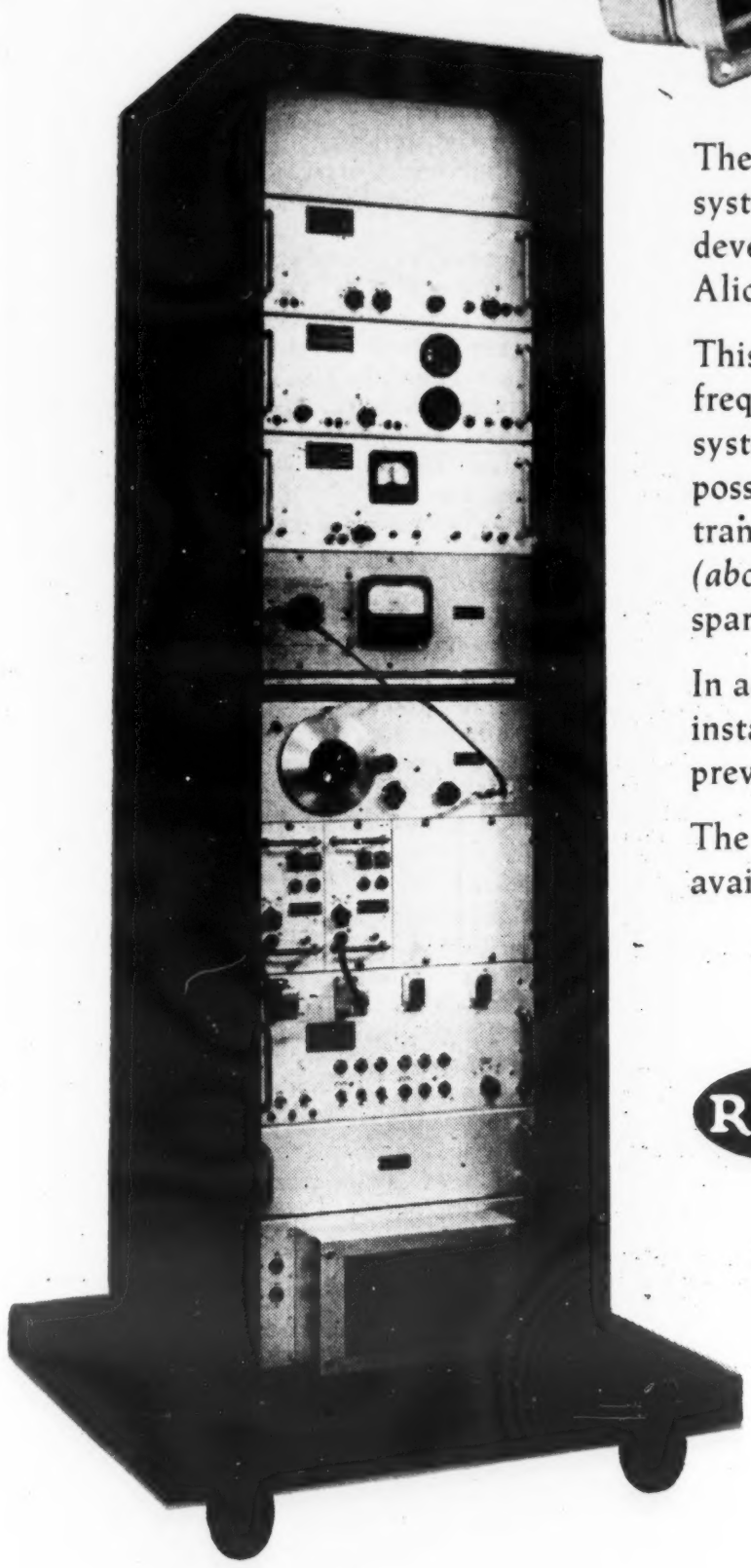
DEAR SIR:

We are all very pleased with the generous play you gave our story on "The Trend of Facsimile in Military Communications" in the July issue of SIGNAL. Thank you for giving us the opportunity to present it.

Sincerely yours,
A. G. COOLEY
Exec. Vice Pres.
Times Facsimile Corp.

RELIABILITY ASSURANCE





The operating reliability of White Alice, largest tropo scatter system yet conceived, is of the utmost importance. REL, which developed and manufactured all scatter radio equipment for White Alice, has also devised the easily movable test bay *(left)*.

This bay permits system level settings to be made, measures system frequency response, and enables noise loading tests which measure system intermodulation of two or more stations. It also makes possible precise measurement of carrier frequency while the transmitter is in service. The incorporated monitor converter *(above)* provides a loop between a station's spare transmitter and spare receiver for all of the above tests.

In addition, any panel from transmitter exciters or receivers can be instantly inserted in REL's unique test bench, pictured in a previous advertisement, for complete measurement and testing.

The skills and experience which achieved these solutions are also available for your specialized radio problem.

REL

Radio Engineering Laboratories·Inc.

36-40 37th St · Long Island City 1, N Y

STillwell 6-2100 · Teletype: NY 4-2816

Canadian representative: AHEARN & SOPER CO · 384 BANK ST · OTTAWA

AFCEA Group Members

Communications—Electronics—Photography

Listed below are the firms who are group members of the Armed Forces Communications and Electronics Association. By their membership they indicate their readiness for their share in industry's part in national security. Each firm nominates several of its key employees or officials for individual membership in AFCEA, thus forming a group of the highest trained men in the electronics and photographic fields, available for advice and assistance to the armed services on research, development, manufacturing, procurement, and operation.

Admiral Corp.
Aircraft Radio Corp.
Allied Control Co., Inc.
Allied Radio Corp.
American Cable & Radio Corp.
American Electronic Laboratories, Inc.
American Institute of Electrical Engineers
American Machine & Foundry Co.
American Radio Relay League
American Telephone & Telegraph Co.
American Telephone & Telegraph Co., Long Lines Dept.
Ampex Corp.
Amphenol Electronics Corp.
Anaconda Wire & Cable Co.
A. R. F. Products, Inc.
Arnold Engineering Co.
Atlas Precision Products Co.
Automatic Electric Co.
Automatic Electric Sales Corp.
Automatic Telephone & Electric Co., Ltd.
Barker & Williamson, Inc.
Barry Controls, Inc.
Bell & Gossett Co.
Bell Telephone Company of Pa.
Bell Telephone Laboratories, Inc.
Bendix Radio Division, Bendix Aviation Corp.
Blackburn Electronic Corp.
Bliley Electric Co.
Bomac Laboratories, Inc.
British Thomson-Houston Co., Ltd.
Bruno-New York Industries Corp.
Burroughs Corp.
California Water & Telephone Co.
Cambridge Thermionic Corp.
Capitol Radio Engineering Institute, Inc.
Carolina Telephone & Telegraph Co.
Central Technical Institute
Chesapeake & Potomac Tel. Co.
Cincinnati & Suburban Bell Tel. Co.
Collins Radio Co.
Columbia Broadcasting System, Inc.
Compagnie Francaise Thomson-Houston
Contraves Italiana
Convair, Division of General Dynamics Corp.
Cook Electric Co.
Copperweld Steel Co.
Cornell-Dubilier Electric Corp.
Craig Systems, Inc.
Crosley Division-Avco Mfg. Corp.
Dana, P. A., Inc.
Designers for Industry, Inc.
DeVry Technical Institute
Diamond State Telephone Co.
Dictaphone Corp.
DuKane Corp.
DuMont, Allen B., Laboratories, Inc.
Eastman Kodak Co.
Electronic Associates, Inc.
Electronic Communications, Inc.
Elgin Metalformers Corp.
Fairchild Camera & Instrument Corp.
Farnsworth Electronics Co.
Federal Telecommunication Laboratories
Federal Telephone & Radio Co.
General Aniline & Film Corp.
General Cable Corp.
General Communications Co.
General Electric Co.
General Telephone Corp.
Gilfillan Bros., Co.
Globe Wireless, Ltd.
Gray Manufacturing Co.
Hallamore Electronics Co.
Haller, Raymond and Brown, Inc.
Hallicrafters Co., The
Haloid Co.
Hazeltine Electronics Division, Hazeltine Corp.
Heinemann Electric Co.
Hercules Motor Corp.
Hitemp Wires, Inc.
Hoffman Laboratories, Inc.
Hogan Laboratories, Inc.
Hoover Electronics Co.
Hopkins Engineering Co.
Hughes Aircraft Co.
Hycon Eastern, Inc.
Illinois Bell Telephone Co.
Indiana Bell Telephone Co.
Indiana Steel & Wire Co.
Institute of Radio Engineers
International Business Machines
International Resistance Co.
International Telephone & Telegraph Corp.
Jacobsen Manufacturing Co.
Jansky & Bailey, Inc.
Kellogg Switchboard & Supply Co.
Kin Tel
Kleinschmidt Laboratories, Inc.
Koiled Kords, Inc.
Lansdale Tube Co., Division of Philco Corp.
Leich Sales Corp.
Lenkurt Electric Co.
Lenz Electric Manufacturing Co.
Lewyt Manufacturing Corp.
Librascope, Inc.
Loral Electronics Corp.
Machlett Laboratories, Inc.
Magnavox Co.
Maida Development Co.
Mallory, P. R., & Co., Inc.
Materiel Telephonique Co.
Michigan Bell Telephone Co.
Montgomery Co., The
Motorola, Inc.
Mountain States Telephone & Telegraph Co.
Mullard Ltd.
Muter Co.
Mycalex Corporation of America
National Co., Inc.
Nelson Technical Enterprises
Nems-Clarke, Inc.
New England Tel. & Tel. Co.
New Jersey Bell Telephone Co.
New York Telephone Co.
North Electric Co.
Northwestern Bell Telephone Co.
Oak Manufacturing Co.
Ohio Bell Telephone Co.
O'Keefe & Merritt Co.
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Pacific Mercury Television Mfg. Corp.
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Philco Corp.
Photographic Society of America
Plessey Co., Ltd.
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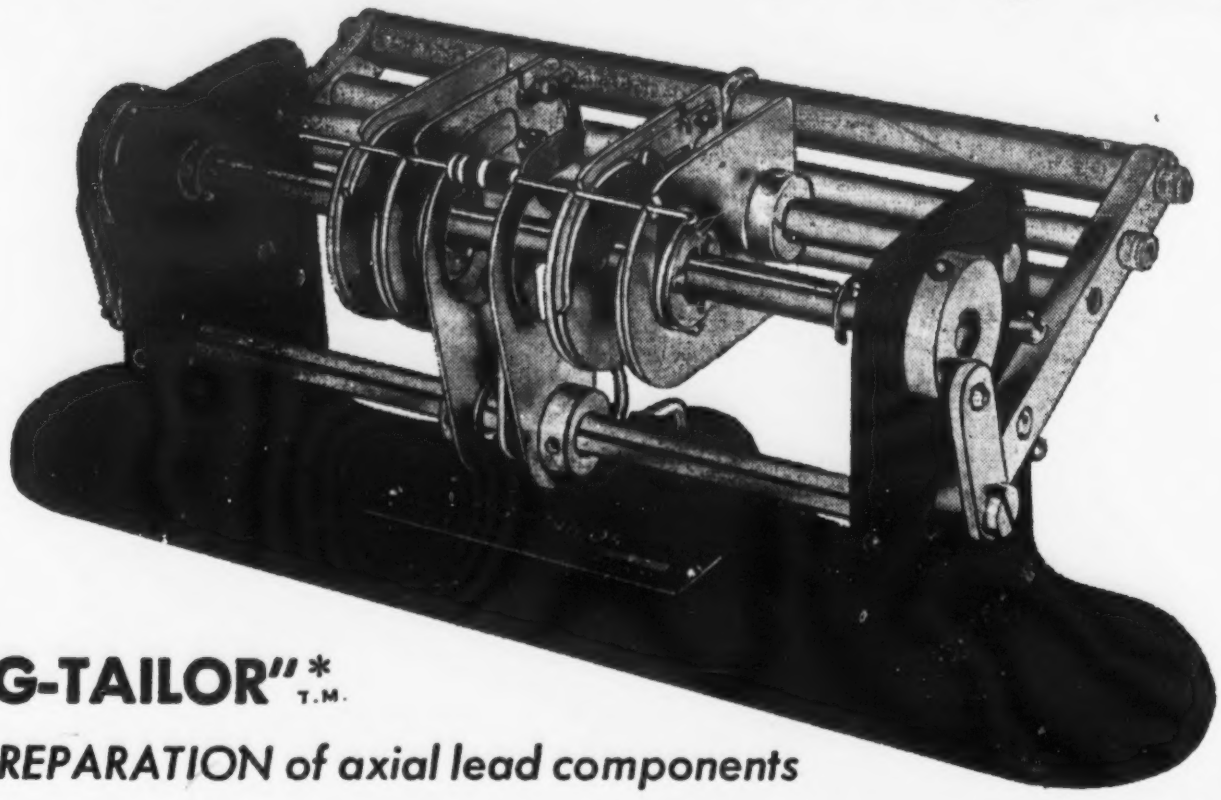
Radio Corporation of America, Defense Electronic Products
RCA Great Britain, Ltd.
Radio Engineering Laboratories, Inc.
Ramo-Wooldridge Corp.
Raytheon Manufacturing Co.
Red Bank Division, Bendix Aviation Corp.
Reeves Instrument Corp.
Remington Rand, Division of Sperry Rand Corp.
Remler Co., Ltd.
Rocke International Corp.
Saxonburg Ceramics
Society of Motion Picture & Television Engineers
Sonotone Corp.
SoundScriber Corp.
Southern Bell Telephone & Telegraph Co.
Southern New England Telephone Co.
Southwestern Bell Telephone Co.
Sperry Gyroscope Co., Division of Sperry Rand Corp.
Sprague Electric Co.
Stackpole Carbon Co.
Standard Telephone & Cables, Ltd.
Stanford Research Institute
Stelma, Inc.
Stewart-Warner Corp.
Stromberg-Carlson Co., Division of General Dynamics Corp.
Surprenant Mfg. Co.
Sylvania Electric Products, Inc.
Technical Materiel Corp., The
Tele-Dynamics, Inc.
Telephonics Corp.
Teletype Corp.
Tensolite Insulated Wire Co., Inc.
Texas Instruments, Inc.
Times Facsimile Corp.
T.M.C. (Canada) Ltd.
Trad Electronics Corp.
Transitron Electronic Corp.
Triad Transformer Corp.
Tung-Sol Electric, Inc.
United Telephone Co.
United Transformer Co.
Waterman Products Co., Inc.
Webster-Chicago Corp., Government Division
West Coast Telephone Co.
Western Electric Co., Inc.
Western Union Telegraph Co.
Westinghouse Electric Corp.
Weston Electrical Instrument Corp.
Wheelock Signals, Inc.
Wickes Engineering & Construction Co.
Wilcox Electric Co., Inc.
Willard Storage Battery Div., Electric Storage Battery Co.
Wisconsin Telephone Co.
Wollensak Optical Co.
Zenith Radio Corp.

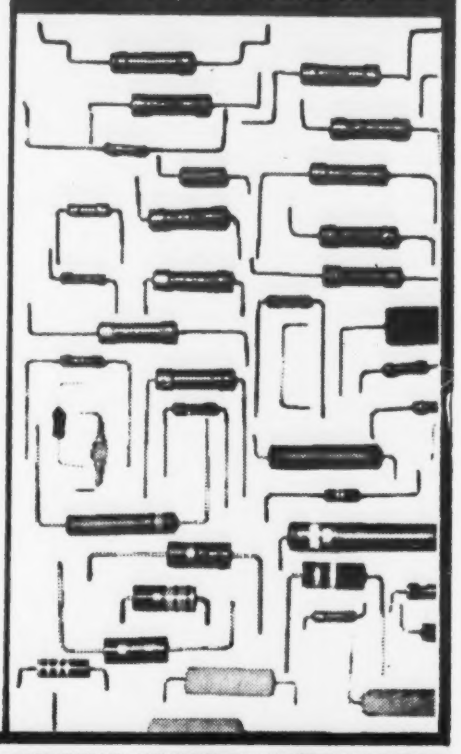
PROVEN-on the assembly line!



"PIG-TAILOR"* T.M.

For PREPARATION of axial lead components

PREPARED COMPONENTS IN SECONDS WITH THE "PIG-TAILOR"



"PIG-TAILORING"

. . . . a revolutionary new mechanical process for higher production at lower costs. Fastest PREPARATION and ASSEMBLY of Resistors, Capacitors, Diodes and all other axial lead components for TERMINAL BOARDS, PRINTED CIRCUITS and MINIATURIZED ASSEMBLIES.

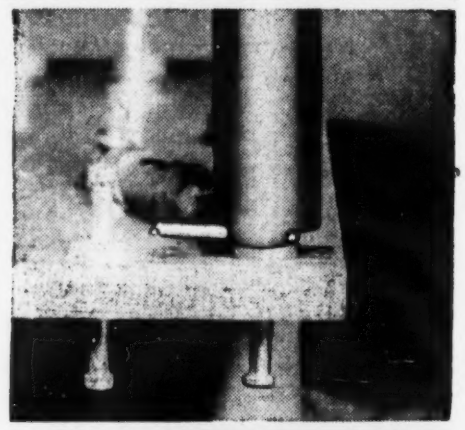
The "PIG-TAILOR" plus "SPIN-PIN"—accurately MEASURES, CUTS, BENDS, EJECTS & ASSEMBLES both leads simultaneously to individual lengths and shapes—3 minute set-up—No accessories—Foot operated—1 hour training time.

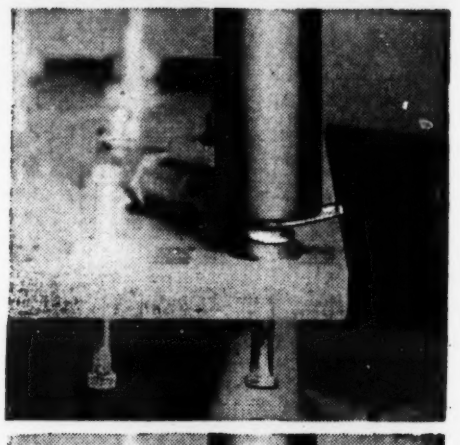
PIG-TAILORING provides:

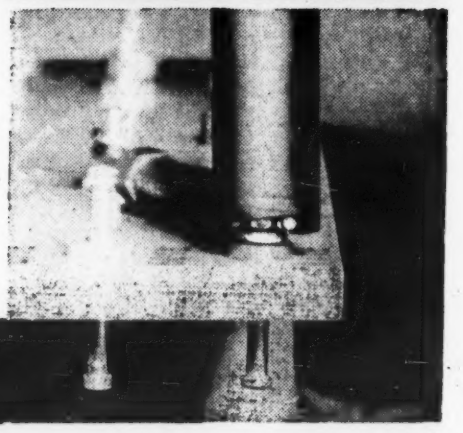
1. Uniform component position.
2. Uniform marking exposure.
3. Miniaturization spacing control.
4. "S" leads for terminals.
5. "U" leads for printed circuits.
6. Individual cut and bend lengths.
7. Better time/rate analysis.
8. Closer cost control.
9. Invaluable labor saving.
10. Immediate cost recovery.

PIG-TAILORING eliminates:

1. Diagonal cutters!
2. Long-nose pliers!
3. Operator judgment!
4. 90% operator training time!
5. Broken components!
6. Broken leads!
7. Short circuits from clippings!
8. 65% chassis handling!
9. Excessive lead tautness!
10. Haphazard assembly methods!







"SPIN-PIN"* T.M. Close-up views of "SPIN-PIN" illustrate fast assembly of tailored-lead wire to terminal.

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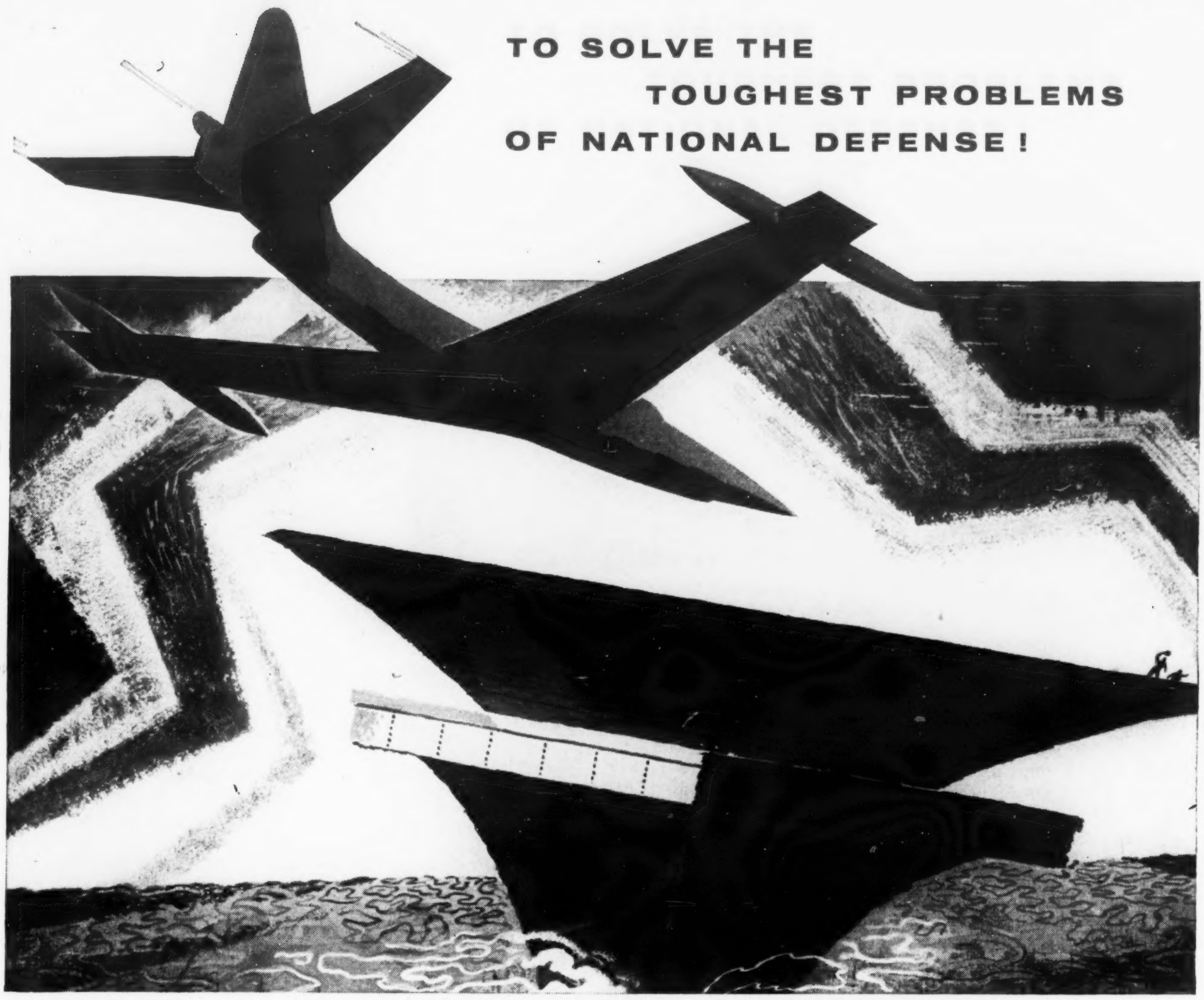

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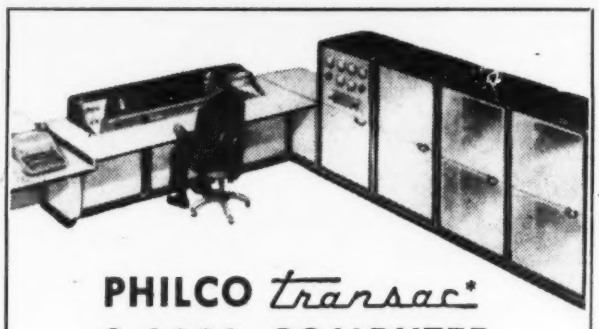

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Chapter News

Atlanta—President elect Lt. Col. Donald L. Adams (left) and Charles M. Eberhart, retiring president of the chapter, greet Lt. Col. John V. Fill, Chief of the Electronics Branch, Army Ballistic Missile Agency, who was guest speaker at the May meeting.

Atlanta

Lt. Col. John V. Fill, Chief of the Electronics Branch of the Army Ballistic Missile Agency, Huntsville, Alabama, spoke on "The Army Missile Program," at the chapter's May meeting.

During the business session, new officers were elected as follows: president — Lt. Col. Donald L. Adams, Third Army Signal Section, Fort McPherson; vice presidents — Arthur E. Arnold, Western Union Telegraph Company; Robert J. Smith, Atlanta General Depot and Elmo F. Stewart, Georgia Institute of Technology.

Augusta—Fort Gordon

Col. David P. Gibbs, new commander of the U. S. Army Signal Training Center, was introduced to the chapter at its June 20th meeting by Col. Braxton E. Small, chapter president.

Principal speaker of the evening was 1st Lt. Richard M. Dumont, program director of the U. S. Army's Southeastern Signal School's television branch. His topic was "Commercial Television."

Gulf Coast

At the July business meeting, President Ancil Arseneau reported on the events of the national convention at which he had represented the chapter, and plans were made for increasing membership and providing interesting programs during the coming year.

Roy L. Hipple was appointed to fill the vacancy in the position of chapter treasurer.

The chapter also reviewed its experience in stimulating interest in electronics among local high school students during the past year and various recommendations were made to implement this program in the next school term.

Hawaii

Feature of a recent meeting was a boat tour of Pearl Harbor arranged by the Navy members of the chapter. Special guests at the luncheon which followed at the Commissioned Officers' Mess were introduced by Col. Glenn Meader, chapter president, as follows: Brig. Gen. Herbert L. Scofield, Commanding General, USA Base Command, and Brig. Gen. Don Graul, Commander of the 1808 AACS Wing.

At the annual elections, Col. Wayne L. O'Hern, USAF, was chosen to head the chapter during the coming year. The other new officers are: vice presidents—Capt. Frank A. Dingfelder, USN; Julian Lamboley, USARPAC; secretary — CWO Joseph B. Milligan, USAF; treasurer — Mary Evans, Navy ComSta; National Council member—Louis Robello, Hawaiian Telephone Company.

Kansas City

About ninety members and guests journeyed from Kansas City to Fort Leavenworth, there to be joined by about fifteen officers, for the April meeting. The host, as well as the speaker of the evening, was Lt. Col. John Clapper of the Command and General Staff College.

Upon arrival, the group witnessed a display of television and electronic equipment currently in use by the Signal Corps.

Following dinner at the Officers' Club, Colonel Clapper gave a brief resume of the history and purpose of the Command and General Staff College. He then spoke on the subject of "Signal Communications in Atomic Warfare."

Special guests of the chapter were Col. John R. Howland, regional vice president, and Lt. Col. Colwill of the Australian Communication Corps.

At its May 23rd meeting, new officers and directors were elected for the coming year. Lt. Col. G. D. Meserve, USAF (Ret.), former president of the Montgomery (Ala.) Chapter, was chosen to head the chapter. Vice presidents are: D. E. Busse, Wilcox Electric Co.; Lt. Col. E. N. Jenkins, SigC, Fort Leavenworth; J. T. Naylor, United Telephone Co.; secretary-treasurer—M. H. Tyrell, Southwestern Bell Telephone Co.

Board of directors: Cornelius Ashley, Southwestern Bell Telephone Co.; Lt. Col. Z. W. Barnes, Richards-Gebaur AFB; C. L. Buell, Western Union Telegraph Co.; R. E. Conrath and A. J. Esrey of American Telephone and Telegraph Co.; J. G. Kreamer, United Telephone Co.; W. G. Rider, Rider-Philpott Studio; J. T. Wallingford, Central Technical Institute; W. R. Wheeler, AT&T Co., and J. V. Wilcox, Wilcox

London—British Telecommunications Research, Ltd., was host to the chapter for its April meeting. Above, chapter members witness a demonstration of telegraph distortion measurement and a regenerative repeater during a tour of the company's facilities.

Electric Co.

Speaker of the evening was Col. John B. Bestic, Chief of the Communications-Electronics Division of the Strategic Air Command, Omaha, Nebraska, whose subject was "The Strategic Air Command and Communications-Electronics." Colonel Bestic illustrated his talk with factual slides outlining some of the functions of SAC and stressed the importance of communications and electronics in this arm of national defense.

London

British Telecommunications Research, Ltd., was host to the chapter for a dinner-meeting and tour of its facilities on April 26th. Arrangements for the event were made by Automatic Telephone & Electric Co., Ltd., group member of the AFCEA, and Sir Archibald Gill, Director and General Manager of BTR.

Of particular interest in the tour and demonstrations were the pilot regulator and amplifier, negative impedance, telegraph storage on magnetic drum, telegraph distortion measurement and regenerative repeater.

Following dinner, Mr. F. P. Morrell, BSC, M.I.E.E., presented a short talk on the activities of British Telecommunications Research, Ltd.

The chapter's annual meeting was held on May 28th at the Columbia Club, and new officers were elected as follows: president — Lt. Col. John T. Tyler, USAF; vice presidents — Capt. H. Williams, Jr., USN; Col. J. A. Plihal, USAF; Cdr. C. G. Mayer, RCA Great Britain, Ltd.; Maj. C. L. Bachtel, USA; associate vice presidents — Michael Clark, The Plessey Co., Ltd.; J. J. Eades, Automatic Telephone & Electric Co., Ltd.; T. E. Goldup, Mullard, Ltd.; Sir Reginald Payne-Gallwey; treasurer — Maj. Fred E. Stant, USAF; associate treasurer—P. D. Canning, The Plessey Co., Ltd.; secretary —Capt. H. W. Gipple, USAF; associate secretary—L. T. Hinton, Standard Telephone & Cables, Ltd.

Capt. Edward Metzger, chapter president, gave a detailed report on the annual convention which he had attended in Washington in May. At the conclusion of the meeting, he was given a standing vote of thanks for his leadership during the past year.

New York

Members of the chapter, their ladies and guests enjoyed a most successful meeting at Governor's Island on June 12. Held at the Officers' Club, the evening included cocktails, a buffet supper and dancing. This was the last chapter meeting until September and no business was transacted.

Among the 225 in attendance was Rear Adm. Frederick R. Furth, new National President of the AFCEA.

Philadelphia

Professor Francis Davis, Professor of Physics and Meteorology at Drexel Institute, was guest speaker at the chapter's April meeting and discussed "Meteorological Measurements." Professor Davis is well known in the Philadelphia area for his broadcasts and telecasts of the weather over WFIL and WFIL-TV.

The meeting was held in the Skyview Terrace Dining Room at the International Airport, and was preceded by a social hour and dinner.

Philippine

Col. Orville Laird, Director of Communications, Hq. Thirteenth Air Force, was elected president of the chapter at its June 15th meeting.

The other new officers are: vice president—Cdr. George Partis, NAVCOMMFACPHIL; treasurer — Jay Howe, 2720th Maintenance Group; secretary —Robert C. Young, Radio Electronics Hqs., Inc.

Pittsburgh

The chapter's annual dinner party was held at Buffalo Inn, South Park, on June 6th. The entertainment featured a special program of 3-dimensional music by Earl LaFean, chapter member.

Recently elected officers were introduced as follows: president — George H. Aderhold, Saxonburg Ceramics Co.; vice presidents — H. S. Brown, Mine Safety Appliance Co.; Maj. John T. Dabinett, Carnegie Institute of Technology; H. Lundberg, Shields Rubber Co.; R. C. Ridley, Copperweld Steel Co.; J. I. Seitz, Union Switch & Signal; W. H. Yates, Western Union Telegraph Co.; H. D. Choate, Bell Telephone Co. of Pa.; secretary—Harry W. Shepard, Jr., Stanwix Autopark; treasurer — F. K. Wunderlich, Pennsylvania Railroad Co.; member executive committee — Harold W. Mitchell (retiring president), Bell Telephone Co. of Pa.

Board of Directors: E. W. Breisch, Union Switch & Signal; John Wesner, Carnegie Institute of Technology; A. M. Crawford, Pennsylvania Railroad Co.; F. E. Leib, Copperweld Steel Co.; S. E. Phillips, Bell Telephone Co. of Pa.; E. J. Staubitz, consulting engineer; S. C. Stoehr, Jr., Bell Telephone Co. of Pa., and R. W. Hill, Hamburg Brothers, Inc.

Rome-Utica

Officers elected at the April meeting were officially installed on June 19th at a dinner-meeting at the Officers' Club, Griffiss Air Force Base. Robert A. Rodriguez, outgoing chapter president and organizer of the chapter, was the installing officer.

Program feature of the evening was a film, "The WAC of Shangri-La Fame," which was of particular interest since it depicts the true jungle crash and adventure of Rome's own Mrs. Margaret J. Atkinson of Rome Air Development Center. Also shown was a short film on the crash rescue radio equipment which is being developed by the Air Research and Development Command to speed up locating crashed aircraft.

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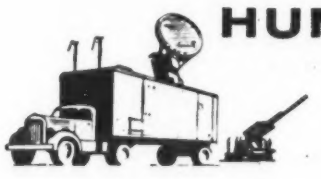

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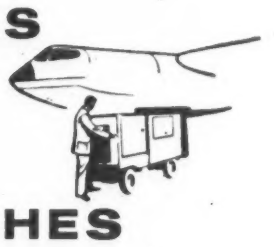

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Tokyo—Program for the chapter's May 3rd meeting was sponsored by the Air Force, with "The Role of Communications and Electronic in the Air Force" as the theme. Pictured at the head table, left to right, are: Capt. Robert H. Weeks, COMNAVFE, chapter director Col. Charles J. Harrison, FEAF, chapter director; Brig. Gen. Cecil P. Lessig, Commander, 41st Air Division, keynote speaker; Chapter Pres James T. Ramsey, Philco Corp.; Col. Aubrey R. Morley, Sig Sec., Hq. AFFE, vice pres., and Col. Thew J. Ice, Hq. FEC, program chairman

Rome-Utica—New officers installed at the June meeting, left to right: Albert D. Reisenberg, treasurer; William L. Roberts, 3rd vice president; Murray Socolof, 1st vice president; Allan A. Kunze, president; Robert A. Rodriguez, outgoing president and installing officer; Charles A. Strom, Jr., 2nd vice president; Darrell S. Kirby, secretary.

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Scott-St. Louis

A dinner-dance on June 7th at Augustine's Restaurant in Belleville, Ill., recessed chapter activities for the summer months.

During the business session, Col. C. W. Gordon, chapter president, reported on the events of the national convention, and plans were made for the opening meeting in September.

Program feature was "Hemo, the Magnificent," the second color film in the Bell System's series of science films.

Southern Connecticut

KIP Electronics Corporation, Stamford, furnished the program for the June 13th meeting, with George W. Baker, president, and John N. Higgins, sales manager, as the speakers.

The discussion and demonstration explained how a new tube type comes into existence, tracing the progress from the original presentation of the problem through to the successful achievement — a new tube. KIP Electronics provides a unique service to government and industry in that special purpose tubes may be provided to solve tube function problems where no existing tube will do the job.

During the business session, Edward A. Chmielewski of SoundScriber Corporation was named to the post of chapter treasurer to fill the vacancy created by the transfer of Bernard Rosenberg to Philadelphia.

Tinker-Oklahoma City

Dr. James G. Harlow, Executive Vice President of the Frontiers of Science Foundation of Oklahoma, addressed the chapter's June 28th dinner-meeting at the Tinker Air Force Base Officers' Club. His authoritative presentation, "The Citizen of the New Frontiers," was considered outstanding by the chapter audience. Dr. Harlow was introduced by Professor Ansel P. Challenner of the University of Oklahoma.

Dr. Harlow is a Fellow of the Oklahoma Academy of Science. During World War II, he served in the Navy and received a special commendation for his work in organizing and admin-

CHAPTER NEWS

istering one of the Navy's advanced technical schools for officers. He holds the rank of Commander in the U. S. Naval Reserve. Now on the staff of the University of Chicago, his current teaching and research interest lies in the fields of science, education, higher education and administrative theory. During 1957 he is on leave from the University to act as Executive Vice President of the Frontiers of Science Foundation of Oklahoma.

Tokyo

The importance of Communications and Electronics in the Air Force was forcibly pointed out by Air Force-host guest speaker, Brig. Gen. Cecil P. Lessig, Commander of the 41st Air Division, Japan, at the May 3rd chapter luncheon. Held at the Rocker-4 Club in Tokyo, the meeting was sponsored by the Air Force in the Far East and featured displays of Air Weather Service, AC/W, AACS and Airborne Electronics.

General Lessig paid high tribute to all AFCEA members and guests for their splendid effort in the field of electronics, and pointed out that without the aid of electronics *no defense would be possible*. He explained that, with the increase in speed of aircraft, electronics and electronics people must bear a larger share of the responsibility for providing effective weapon systems.

The General went on to draw a comparison between the 1941 aircraft-electronics system and the present and future systems look. He stated that with new speeds and altitudes possible there is a vital need for more reliability and effectiveness in electronic systems. He also stressed the fact that clumsiness of hand and slowness of mind must be overcome in dealing with these new speeds. In the old days, he said, we had minutes to hours to play with but now we must think in terms of seconds, and possibly micro-seconds, if we are going to cope with speeds ranging from mach 2 to 10.

General Lessig concluded his talk by encouraging greater effort be expended on new techniques and developments through research and development. He said "push everything and every effort to make improvements possible."

At the conclusion of the meeting, members and guests were invited to tour several Tokyo electronics-optics establishments.

Washington

Chapter president L. Harris Robinson, Motorola, Inc., reports that the monthly luncheons will be resumed at the Willard Hotel in October. Monthly luncheons will run through to include June 1958. John Gilbarte, Admiral Corp., has been selected as program chairman.

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TI-built guidance and control systems fit into extremely cramped quarters aboard many of the latest U. S. missile types. Using advanced miniaturizing methods and rugged TI semiconductors, Texas Instruments is playing an important role in the creation of missiles that fly farther and faster . . . with greater payload and reliability.

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ITEMS OF INTEREST

From Government, Industry and the Services

Sun Rays To Power Satellite Instruments

Instruments within an earth satellite will be able to draw their required electrical power from the sun. During recent experimentation, engineers from the U.S. Army Signal Engineering Laboratories, Fort Monmouth, N. J., proved that solar batteries may provide an ideal power source.

Army scientists attached glass-protected solar cell clusters to the skin of an Aerobee-Hi rocket launched by the Navy at White Sands Proving Ground, New Mexico. Approximating satellite conditions, the rocket was fired to an altitude of 190 miles. The batteries, of tiny silicon wafers, functioned with only slight electrical output variance.

Until the rocket's radio re-entered dense atmosphere and ceased functioning, telemetered data indicated that the cells had provided continuous power during the flight.

As visualized by scientists, the solar cells attached to the skin of the earth satellite would supply instrument power for approximately the 60 minutes the vehicle would circle the earth in the sun. They also could charge small nickel-cadmium batteries to provide electricity during the remaining 40 minutes the satellite travels in the earth's shadow.

Further tests are to be conducted during some of the early satellite launchings.

New Amplifier Uses Ferrites

Research physicists at Bell Telephone Laboratories have successfully operated a new solid-state microwave amplifier using a ferrite material as the active element.

Functioning at room temperature, this ferro-magnetic development is expected to have a much lower noise level than conventional microwave amplifiers. The device should prove valuable in correcting weak microwave signals in radio astronomy, microwave relaying and radar fields.

Although the amplifier has certain superficial similarities to the solid-state spin oscillator, both must be supplied power from an oscillator operating at a higher frequency than the signal to be amplified.

It appears that ferromagnetic amplifiers can be designed for operation in practically any portion of the microwave spectrum. Preliminary results indicate that the band width is adequate for many applications. Thus, although still in the experimental stage, the discovery may lead the way to an entirely new group of ferrite microwave devices.

Life Can Exist On Mars

First results of an eight-month-old Air Force research project show that life can exist on Mars. Living specimens were cultivated under conditions approximating planet environmental extremes and not only survived but flourished.

The living organisms, bacteria which thrive on nitrogen, were placed in soil samples collected from the more desolate regions of the U. S.

Conducted at the Air Force School of Aviation Medicine near San Antonio, the tests included duplicating temperatures which range from 70 degrees Fahrenheit to 95 degrees below zero. The air on Mars is nearly all inert nitrogen—probably less than one per cent is oxygen. Pressure is the same as that found in the stratosphere and the water supply is less than the content of the earth's dryest deserts.

A certain number of the bacteria survived paralleled conditions and were able to reproduce in a moisture content of only two-fifths of one per cent.

Safety Measure For Jets

The Sperry Gyroscope Company, Great Neck, N. Y., has developed an electronic method for monitoring jet engines, both in flight and on the ground. The simple device will make safer jet travel and greater military mission reliability possible.

Weighing 15 pounds, the new equipment "routinely" picks out and measures selected vibrations within the recesses of jet power plants.

A warning of impending trouble is given when unusual vibrations — caused by inbalance of rotating parts —are present and when normal engine vibration limits are being exceeded.

Compact, permanently-installed airborne units will enable airline and military flight crews to precisely monitor the performance of jet engines in flight, thus assuring increased safety. They will also be able to spot quickly imminent disturbance that otherwise might require the attention of a team of ground maintenance technicians.

The Air Force, which makes wide use of the company's analyzing equipment with piston engine aircraft, has scheduled preliminary tests for the new "jet system." The Navy also plans tests, and airline executives are negotiating for its installation in turbo-prop and turbo-jet aircraft on order.

"Solion" Rivals Vacuum Tube

The Naval Ordnance Laboratory recently reported the development of a device that may replace the vacuum tube and even the transistor in performing some functions in electronic circuits.

Nicknamed the "solion," the electrochemical unit depends upon the movement of ions in a solution rather than in a gas or vacuum.

Application of the device might conceivably range from guidance of aircraft to use in burglar and fire alarm systems.

G. E. Announces Fusion Research

The General Electric Research Laboratory has launched a scientific search aimed at developing safe and inexpensive power from the fundamental process of the hydrogen bomb.

According to Dr. Guy Suits, G.E. vice president and director of research, a "substantial research program" to study the fusion process has been underway at Schenectady, N. Y., for more than a year.

"Fusion technology, as now conceived, employs the most basic technical skills of the electrical industry, and it is inevitable that the industry will contribute heavily to this important development," Dr. Suits said.

Thus far, research on fusion has been more productive of "hope than power" but eventually a reluctant nature must be made to yield a controlled thermonuclear reaction for energy generation, he added.

"My own view," Dr. Suits stated,

"is that five additional years of research will be required to make possible a realistic appraisal of the fusion process; in ten years we may be at the point of technical feasibility; pilot-plant production of fusion power will not begin for twenty years and competitive power production lies beyond that."

During this period of discovery and development, the production of power by fission, which is technically feasible today, will rapidly become competitive with older energy sources, he predicted, adding that experience accumulated in producing atomic power by fission will be invaluable when fusion becomes practical.

WESCON Field Trips

A number of field trips have been scheduled for the ninth annual Western Electronic Show and Convention in San Francisco, August 20-23. WESCON will offer the expected 30,000 registrants a choice of organized visits to research laboratories, manufacturing plants, military installations and other points of professional interest to electronics engineers.

Included in the itinerary are tours of two military defense facilities—a U.S. Army NIKE missile installation and the U. S. Naval Radiological Defense Laboratory at Hunter's Point, San Francisco.

A group, limited to 150 U.S. citizens, will observe progress on the first nuclear-powered guided missile submarine, the *U.S.S. Halibut*.

Army Develops New Mask

A protective mask, which will guard the American soldier against chemical, biological, and radiological agents, has been developed by the Army Chemical Corps. Designed to give complete protection against the inhalation of war gases, germ warfare agents and airborne radioactive fallout particles, the mask does not safeguard against direct radiation.

A major feature is the elimination of the protruding canister used currently. Pads of a new lightweight, pliable gas-aerosol filter material are enclosed within cavities molded into the rubber face piece.

In addition, lower breathing resistance, superior vision, better speech transmission and greater comfort are among the advantages of the design.

While the new mask still must undergo rigorous tests before it can be adopted as standard, the principles incorporated are believed sound.

The mask was produced with the assistance of the John T. Ryan Memorial Laboratory of the Mine Safety Appliances Company, of Pittsburgh, Pennsylvania, under a research contract with the Army Chemical Corps.

X-17 Research Rocket

An Air Force research rocket, the Lockheed X-17, has reached the highest speed ever achieved by any instrumented missile. On a number of flights the rocket attained the record speed as it flew into the ionosphere.

The biggest and the most powerful U.S. missile using all solid propellants, the three-stage X-17 is designed to aid in overcoming the re-entry problem. Steps are necessary to prevent long range missiles, which will travel out of the earth's atmosphere in a high arc to their destination, from burning like meteors when they return to the heavy air close to the earth.

Built by Lockheed's Missile Systems Division in Van Nuys, Calif., the 40-foot tall rocket has been fired repeatedly from the long range missile test center at Patrick Air Force Base, Florida. Various materials and shapes were subjected to missile-like re-entry conditions.

"Automatic Navigator" Developed By Navy

Ten years of research have produced an "automatic navigator" which supplies continuous information to pilots. Designed to meet modern, high-speed flight requirements, the new instrument is based on the air-ground radar Doppler system and was developed by the Navy and Ryan Aeronautical Co., San Diego, Cal.

The 200-pound device, designated APN-67, gathers data instantaneously and transmits it as visual display, screening out irrelevant plane motion. Data supplied includes latitude, longitude, ground speed, desired and actual ground track, ground miles traveled and course error.

Mixed-Unit Aircraft Engine

The British recently released news concerning their first mixed-unit aircraft engine. The combined jet and rocket engines were used in the initial flight of the Saunders-Roe S.R. 53.

The mixed-unit aircraft overcomes the previous problem of fall-off in

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ITEMS OF INTEREST

thrust of pure jets at high altitude. Entirely independent of the atmosphere for oxygen to support combustion of a hydro-carbon fuel, the new engine is called the "Spectre." It carries highly concentrated hydrogen peroxide which, through a catalytic process, is transformed into heavily oxygenated, super - heated steam. When mixed with atomized engine fuel and ignited, the steam produces a powerful thrust movement.

Rocket-powered aircraft such as the S.R. 53, are able to climb to operational levels, now in the stratosphere, in a shorter time than previously possible. During the course of the climb, when the altitude begins to rob the jet of its thrust, that of the rocket is increasing. A high rate of climb is maintained up to extreme operational altitudes.

Chemically Made "Mirrors"

Chemically formed "radio mirrors" may insure normal continuance when solar activity interrupts communications. According to Joseph Kaplan, chairman of the United States program for the International Geophysical Year, the "mirrors" will bounce radio waves toward the earth when operations are suspended.

One such "mirror," formed when the Air Force seeded the atmosphere 60 miles up with 10 pounds of nitric acid, bounced radio signals back as intense as the normal ionized layer.

Mr. Kaplan said chemical injections of the upper atmosphere can play a significant role in bettering communications during solar disturbances and are well within the bounds of practicality.

High Altitude Suit Proves Successful

A full pressure high altitude suit, which will afford pilot protection in the stratosphere, has been successfully flight tested by the Navy.

Commander Jack Morrisey, in a turbojet F80 Crusader, demonstrated that pilots will be able to fly a supersonic craft in the stratosphere without risk of lowered cabin pressure. At high altitudes exposure to the thin atmosphere would boil a man's blood in seconds.

The new suit, made of nylon and rubber, also retains life saving pressure in the event a man bails out at stratospheric altitudes. In addition, it will keep the pilot afloat and free from exposure in cold water.

Although the suits contain their own communication, oxygen and ventilation systems, they have more mobility, better visibility, comfort and protective features than previous models of high altitude equipment.

Antarctic Bases Seek "Ham" Contacts

With Naval Reserve training and electronic units particularly in mind, seven Navy Antarctic bases have made a request for more U.S. amateur radio contacts.

"Ham" radio represents the only direct touch with families and friends available to the 318 Navy men and scientists in the Antarctic.

Amateur radio, according to the Commander of Naval Units in Antarctica, has proven an excellent morale factor and a network would be desirable as a reliable relay for personal messages.

NOTE: Presently, National Headquarters of AFCEA is receiving call letters from "ham" operators who are members of the Association. The purpose of this is to build up within AFCEA an International "Ham" Network. (Note June issue, page 21.) Send us your card. We are working on a plan.

Names in the News

Harold Silverstein, Special Assistant to the Chief Signal Officer, has been awarded the Secretary of the Army's Research and Study Fellowship. He will attend Washington American University and engage in a project on the management and use of Electronic Data Processing Systems for logistical and business type applications within the Army.

Major General E. Blair Garland, one of the ranking communications - electronics officers in the United States Air Force, retired July 31. Prior to his retirement, General Garland served as Chief Signal Officer, SHAPE.

Captain Robert F. Gilbert recently received the Army Commendation Ribbon with metal pendant and a letter of commendation from General Sun Yup Paik, ROK Army Chief of Staff. The recognition was a result of his work as Signal maintenance advisor to the ROK Army. Signal Depot at Pusan, Korea.

Brigadier General Wesley T. Guest, Signal Officer, U.S. Army, Europe, has been assigned to the Sacramento Signal Depot in California. Originally appointed to the Office of the Chief Signal Officer in Washington, General Guest will proceed to California from his current European post and assume his new duties in September.

Frank A. Cowan, whose inventions contributed greatly to telephony, died June 21 in New York after a brief illness. He was 59. Responsible for the development of varistor type modulators and demodulators, his inventions also include a telegraph transmission measuring set. Mr. Cowan was Assistant Director of Operations of the American Telephone and Telegraph Co., Long Line Department.

Brigadier General Alfred R. Maxwell, USAF-Ret., has been named vice president of Hallamore Electronics Co., division of The Siegler Corporation, Anaheim, California. He will direct East Coast operations for the Hallamore division in Washington.

Colonel Bernard M. Wootton, Deputy Director of Communications-Electronics, U.S. Air Force, was recently nominated for the rank of brigadier general. He is a vice president of the Washington Chapter of the AFCEA.

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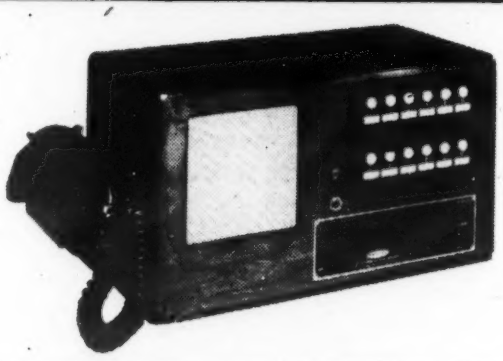

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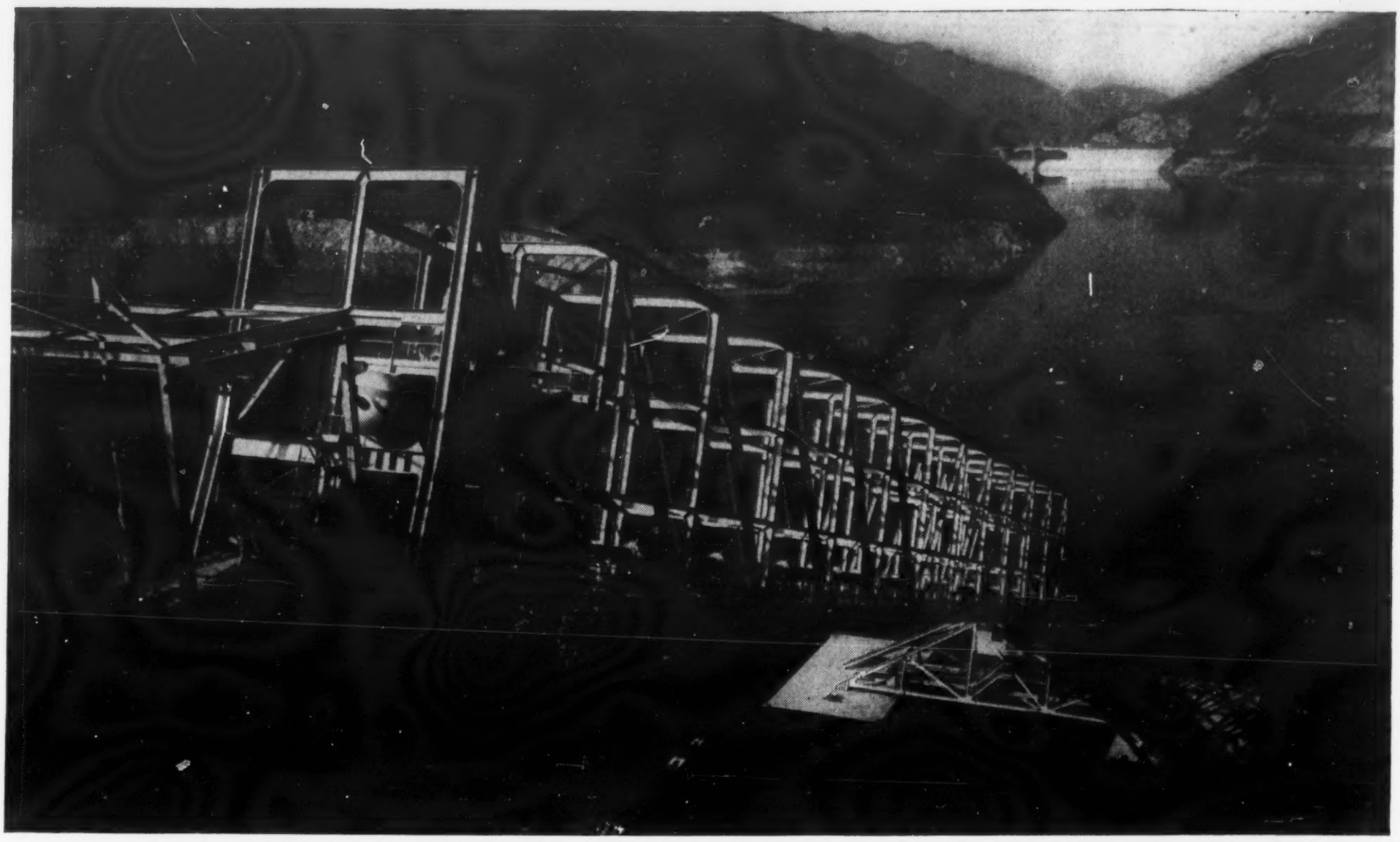

U.S. Navy Photo

The Variable Angle Launcher, one of NOTS' test facilities, is considered the largest "blow-gun" in the world. Experimental missiles are blown into the water through a 300-foot long launching tube.

NAVAL ORDNANCE TEST STATION DESIGNS, DEVELOPS, TESTS ADVANCED WEAPONS

Serving the needs of the fleet and other service branches for superior weapons is the mission of the Navy's largest ordnance research and development center, the U. S. Naval Ordnance Test Station (NOTS) at China Lake and Pasadena, California.

Established in 1943 by the Bureau of Ordnance, NOTS is the "home" of weapons such as the 2.75" MIGHTY MOUSE air-to-air rocket and the recently unveiled SIDEWINDER guided missile. These weapons are products of an effective military-civilian team at NOTS which originates and carries out weapon ideas; designing, developing, and testing guided missiles, rockets, torpedoes, armament-control systems, and other ordnance items until they are completed and ready for mass production.

Many specialized facilities enable the Station to pursue this broad program. Among these are highly instrumented test ranges, transonic and supersonic test tracks, facilities for the development and pilot production of solid and liquid propellants, a naval air unit equipped with planes of many types, a multimillion-dollar research and development laboratory, and other installations.

The main facility of NOTS encompasses over 1,200 square miles of the Mojave Desert 155 miles north of Los Angeles, while underwater ordnance activities are centered at Pasadena, with water test ranges located at Morris Dam, Long Beach, and San Clemente Island. About 4,800 scientists, engineers, and other civilians, and 1,200 military personnel at NOTS installations are constantly striving to develop better weapons for our nation's defense.

This is one of a series of ads on the technical activities of the Department of Defense.

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NEW PRODUCTS FROM INDUSTRY

Instant Radar Maps

Combining the accuracies of radar, the convenience and utility of photography and the speed of electronics, Hycon Mfg. Co., of Pasadena, Calif., recently developed a revolutionary device which presents a photograph of the ground beneath an aircraft, as seen by its radar, thus allowing unprecedented navigational accuracy.

Working equally well day or night, in clear weather or above clouds, the "radar strip recorder" requires neither operator nor dependence upon ground equipment.

This automatic device with its associated fast film processor, is adaptable to practically all types of airborne radar. In addition, the device is useful as a ground recorder of radar or telemeter information relayed from flying radar sets. In such cases, the strip recorder simplifies the task of ground controllers and observers in monitoring the flight path of a missile or drone aircraft.

Using only one liquid bath, the unique developing process functions at a high temperature to obtain the speed of only 10 seconds for development. The strip is then viewed directly on a translucent lighted screen measuring about 9" x 11". Since the process is continuous, the pilot and navigator see a slowly moving portion of a long strip of film which is automatically wound up on a roller in the machine.

High precision optics and advanced electronic techniques provide for manual adjustment to wind drift and automatic correction of distortions due to high altitude.

Type PR-200 Preamplifier

For use with their telemetering receivers, Nems-Clarke, Inc., 919 Jesup-Blair Dr., Silver Spring, Md., has announced their PR-200 Preamplifier. Completely new in design, it is both weatherproof and pressurized so as to permit location at the antenna without encountering moisture problems.

With this new unit employed, line losses as high as 6 db will not decrease the sensitivity of the receiving system by more than a few tenths of a db. The pass band has a uniform response of 3 db over a frequency range of 215-245 megacycles.

This Preamplifier has a self-contained power supply which is controlled from a 1¾" power control panel, designed for mounting in the relay rack with other equipment.

Similar units are available having a uniform response within 3 db over a frequency range of 225-260 megacycles.

Robot Meteorological Station

The Société Télécommande et de Télémécanique, of Boulogne-s u r-Seine, France, has recently installed in the polar region of Antarctica their all-automatic weather forecasting station. Claimed to function for months either in polar or in tropical regions, it will eliminate the previous necessity for supporting operating personnel there.

Powered by batteries, the robot station can emit information at all hours and over a range of 936 miles. It indicates the direction and velocity of winds (up to 144 mph), temperatures from –113° to 140°F., barometric pressure and other desired atmospheric information.

The registering instruments are linked to an electromagnetic "brain" which codes data received, passes it on to the broadcasting unit and stops the broadcast when transmission is completed. The "brain" is directed by a pendulum clock, the system's nerve center.

After sending out its call sign 14 times, the station flashes its bulletin 3 times at dictation speed. Two transmitters of different frequency allow the "brain" to select one for day and the other for night.

Pushbutton Tube Analyzer

A pushbutton vacuum-tube analyzer, said to permit measurements under almost any operating conditions, has been developed at the Laboratory for Electronics, Inc., Boston, Mass.

Featuring a true trans-conductance measurement to an accuracy of 3%, the model 725 electron tube analyzer is said to permit simultaneous measurement of all variables on separate meters. In addition, conductance to 30,000 micromhos can be measured.

Plate and screen voltages from 0-300 volts are available, and grid and suppressor voltages range from plus to minus 150 volts. It is claimed that as low as 1 microamp can be measured.

Other capabilities include end-of-life test, short test, gas test and electrode leakage resistance tests.

Voice for Electronic Brain

A Voice Data Link System, which converts automatic commands of computing machines into verbal messages from a library of pre-recorded words, has been announced by the Electronics Div. of Fairchild Controls Corp., Robbins Lane, Syosset, Long Island, N. Y.

A wide variety of important uses includes air traffic control, airborne warning, remote voice communication, multi-lingual communications and information directory for transportation terminals.

Teamed with an air defense electronic data system such as SAGE, the Voice Data Link provides automatic guidance control of aircraft using existing communications facilities. As the "brain" computes best course and altitude for an intercept, the Data Link transforms the information into a verbal message which is transmitted to the aircraft by a standard voice channel transmitter.

As a multi-lingual communicator at international airports or with NATO commands, stored vocabularies in many languages are used.

Any number of message formats and message lengths can be had by proper programming of the system. The Voice Data Link also provides for simultaneous transmission of more than one message over individual audio channels.

Radar Indicator Recorder

A new Beattie Radar Indicator Recorder designed for airborne fire control systems was recently announced by Beattie-Coleman Inc., 1000 North Olive St., Anaheim, Calif.

This new camera records range and code lights as well as radar reading. Two synchronized counters are provided; one records optically while the other is visible to the operator. In addition, a sweep second hand watch is optically recorded. Binocular viewers of the radar screen contain a filter for minimum eye strain. Moreover, viewing and picture taking is permitted simultaneously.

Holding 100 ft. of 70mm perforated film which is automatically advanced by an electrical drive mechanism, the camera allows exposures either at regular predetermined intervals or at random.

Designed to fit the confines of a cockpit, the new recorder features compactness and dependability.

New Patent: A. A. Kiriloff

Now available from Alexander A. Kiriloff, of London Terrace House, 405 West 23rd St., New York 11, N. Y., is a new device for deflecting from electronic apparatus the disturbances from atmospheric and other statics.

Using emanation of radio-active materials in its process, this device has been granted patent # 2794118, "A. A. Kiriloff *et al*," recently released by the Atomic Energy Commission.

New Directional Antenna

Ainslie Corp. of 312 Quincy Ave., Quincy, Mass., is offering a newly developed microwave antenna for the 100-500 mc band, with a dipole exciter.

Gain of the new antenna is 23 db or better at 500 mc, with minimum side lobes and cross polarization of 20 db or better.

Having a rugged, lightweight, all-aluminum mesh construction, the unit is fully weatherized and corrosive resistant and is now available in both a 12 ft. diameter Model CF-121M and a 14 ft. diameter Model CF-141M.

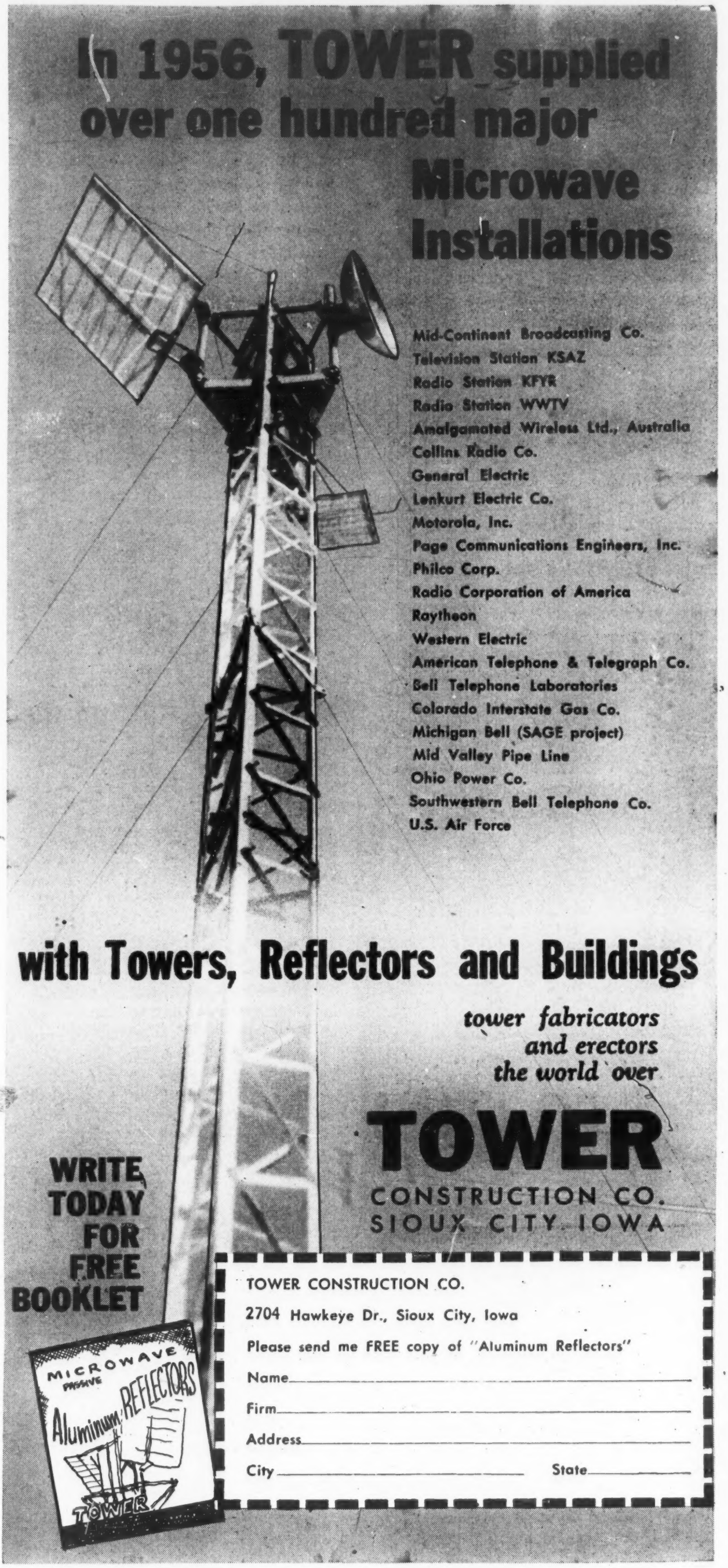
No Transistors In New Miniaturized Terminal

A new miniaturized carrier-telephone terminal, claimed to be a "real break-through" in engineering progress, has been developed by Radio Engineering Products Limited, 1080 University St., Montreal, Canada.

Compared to equipment now in use, the new unit is less than 1/10 the cubic content and ¼ the weight, requires 1/7 as much power and uses only 10 electron tubes, all of a single type. It is further said that transistorized designs are 2.4 as large and more than twice as heavy. Shock-mounted in its carrying case, the complete terminal measures $15\frac{3}{16}$ x $9\frac{7}{8}$ x $9\frac{11}{16}$ inches and weighs 67 lbs. All controls, connections, fuses and tubes are accessible from the front panel.

The terminal provides 4 toll-grade carrier-derived telephone circuits, a voice-frequency order-wire circuit and frequency space for up to 20 carrier-telegraph circuits. Also included are ringing converters, complete test and line-up facilities, automatic transmission regulator and attendant's telephone set.

Operating distances up to 40 miles without intermediate repeaters are possible over standard loaded spiral-4 field cable. From 115 or 230 volts, 45 to 66 cycles, operation requires only 43 watts.



NEW PRODUCTS

"Solar Clock"

A new portable clock which will operate for one month on a day's equivalent of sun or incandescent light, has been announced by General Time Corp., New York. It will be available next Fall from the company's Seth Thomas division.

If exposed periodically to light, the "solar clock" will run indefinitely and is said to be capable of operating for more than a year on stored energy.

The device contains a series of cells that generate voltage when exposed to light. The voltage charges another cell which, in turn, operates the clock.

"Talking" Alarm Device

An alarm system using both radio and magnetic tape to inform proper sources of either fire or burglary emergencies, is now available from Radialarm, Inc., of Toledo, Ohio.

When the system is activated, a radio transmitter broadcasts a prerecorded magnetic tape giving information as to source of broadcast, location and fire box number. Receivers are in fire dept. offices or police headquarters. The message is repeated 3 times.

Copyflo Continuous Printer

The Haloid Co., Rochester, N. Y., pioneers in xerography, have developed a unique, low-cost process for automatic enlarging and reproducing of engineering drawings by means of their new "XeroX Copyflo (R) 24-inch" continuous printer.

Enlarging 35mm microfilm image to a width of 24", the machine prints the drawings on a continuous roll of paper at 20 ft. a minute. No ink is used and the clean, fast electrostatic process requires neither water nor liquid chemicals.

Either positive or negative microfilm may be used, but not inter-mixed. Roll microfilm in either 16mm or 35mm size may also be used with an auxiliary attachment, a change which can be made in 10 minutes.

Cordless Switchboard

Designed to provide large savings in time and space for small concerns having 100 or fewer employees, a new cordless switchboard has been developed by the Bell Telephone Labs., of American Telephone & Telegraph Co.

In contrast to comparable equipment which ordinarily fills a room about 12 feet square, this new unit has switching equipment contained in 2 soundproof cabinets measuring 2¼ x 2½ x 5¼ feet.

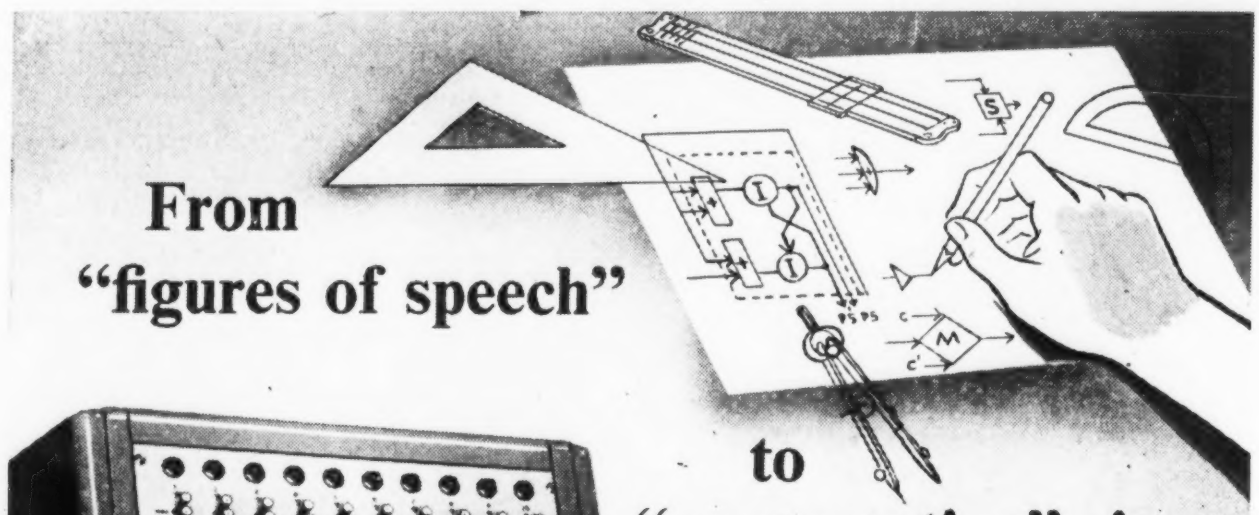
Tiny Timing Tube

Raytheon Manufacturing Co., of Waltham 54, Mass., has developed a new tube the size of a cigarette filter tip that will indicate how long an electronic device has been operating, and thereby prevent costly breakdown of expensive equipment since parts can be replaced before they reach the danger point.

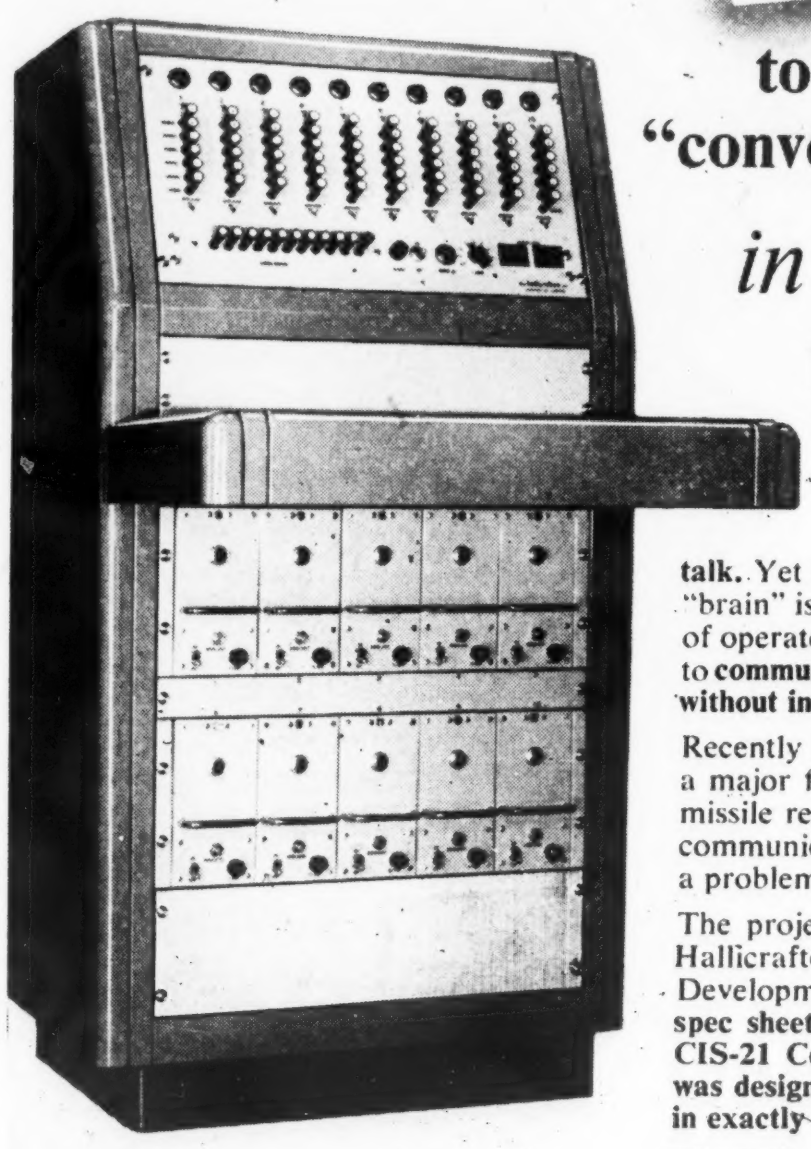
Maximum use of the new tube is expected in equipment requiring super-reliability such as radar, aircraft and computers. Other devices in which the timer can be used include motor bearings, heater elements, burglar alarm systems and transmitter tubes.

Completely self-sealed and impervious to surrounding conditions, the timer can operate immersed in liquid and functions equally well in hot or cold temperatures.

Measuring 1" x ⅜" and weighing less than 1/6 ounce, the tube is simple to install and much cheaper than mechanical timing devices.



From "figures of speech" to "conversation" piece *in 53 days with RDA**



One of the few things today's large electronic computer cannot do is **talk.** Yet the product of its fantastic "brain" is useful only when hundreds of operators and researchers are able to **communicate with perfect teamwork, without interruption or interference.**

Recently Hallicrafters was asked by a major firm engaged in guided missile research to devise a superior communications system to solve such a problem. The need was urgent.

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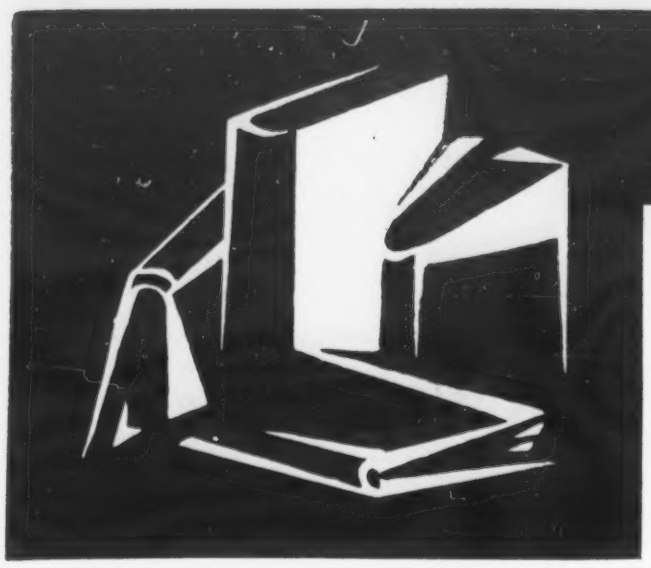

Books

SCATTER PROPAGATION: THEORY AND PRACTICE, by Ira Kamen and George Doundoulakis. Howard W. Sams & Co., Inc., Indianapolis 5, Indiana. 197 pages, $3.00.

Of considerable value to those who wish to familiarize themselves with the work in the field of long range communications, this book was designed for the technicians who will perform the important roles of installing, operating and maintaining the many scatter propagation systems eventually to network the earth.

The theory is presented in simple understandable language. Formulas are outlined to give the technician complete guide lines on how these formulas are applied to scatter propagation engineering practice. It is hoped that the text will lucidly expose the principal problems and the present state of the art.

Data in the text has been carefully collated from the authors' experiences as design engineers and from their conversations with engineering associates and others, all of whom are credited throughout the work.

INTRODUCTION TO UHF CIRCUITS AND COMPONENTS, by Milton S. Kiver. C. Van Nostrand Co., Inc., New York. 408 pages, $7.50.

For those interested in UHF and its use in amateur or in commercial applications, this book presents an exceptionally clear treatment of UHF principles and their application to receivers, convertors and all other equipment.

The purpose of the text is to point out the underlying equality of all radio, whatever the frequency. Concepts of UHF circuits are presented as logical outgrowths of more familiar low-frequency equipment. Discussion of the operation of every component first begins with the simplest statement of how the electrons or waves act and then progresses to a full account of the actual apparatus.

Presentation is geared toward easy comprehension, but the reader is also referred to excellent theoretical treatises for intensive study.

Supplemented by hundreds of specially prepared photographs and diagrams, Mr. Kiver has prepared a valuable coverage of actual operating principles of every element in present UHF equipment.

ANALOG COMPUTERS: THEIR INDUSTRIAL APPLICATIONS. Proceedings of a Symposium, April 1956, Sponsored and Published by Midwest Research Institute, 425 Volker Blvd., Kansas City 10, Mo. 210 pages, 8½" x 11", $5.00.

Compiled from the Proceedings of MRI's 1956 Symposium for Management, this publication contains 13 technical papers plus a transcript of the round-table discussion which, collectively, present a valuable survey and status report on the analog computing field.

Covering the role of the analog computer in both solving and refining technical and non-technical problems, the book includes applications in the design and operation of engineering systems, in flood routing and other hydraulic problems, in economic programming and in industrial control problems.

With the purchase of this publication, a copy of each of the following articles by the MRI staff may be had at no additional charge: 192 — "A Look Back, and Ahead, at Automatic Processing;" 188 — "How Management Looks at Industrial Research:" 180 — "How Operations Research Aids Management;" 168 — "MRI's Analog Computing Facility for Industry."

TRANSISTOR CIRCUIT ENGINEERING, Ed. by Richard F. Shea. John Wiley & Sons, Inc., New York, 46 pages, $12.00.

The first book in the field of transistor research to supply quantitative design information, this work was prepared to combine a proper mixture of basic transistor theory with examples of its proper application in typical circuits.

Detailing up-to-date information on the development of new devices which have opened new fields of utilization, the text provides instruction for actual circuit designing and developing of useable circuits in all potential fields of application.

Lucid directions are given for building successful audio amplifiers, radio frequency amplifiers, etc., using currently available transistors. Moreover, the book shows how to combine these elements into radio receivers, TV sets, and high fidelity audio systems. Mathematical treatment is limited to that necessary for clarity.

Written by members of the General Electric Co. staff, the text is expected to assume a place of authority in the field of transistor research.

STORAGE AND PRESERVATION OF FILM. Eastman Kodak Co., Rochester 4, N. Y., 50¢. (Reviewed by Frank Smith, Photo Ed.)

Motion picture workers who are concerned with the use, storage and preservation of motion picture film will doubtless be pleased to know that a new, illustrated 80-page data book is available to them.

Covering all phases in the care and storage of processed and unprocessed motion picture films, the data book has been planned to meet the needs of film processing laboratories, motion picture studios, theaters, TV stations, libraries, schools, and archives.

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THE TRANSPORTATION CORPS: OPERATIONS OVERSEAS, by Joseph Bykofsky and Harold Larson. Office of the Chief of Military History, Dept. of the Army, Washington, D. C. 671 pages, $6.50.

With this volume, "U. S. Army in W. W. II," the Army completes its trilogy covering the mammoth task of Army transportation involved in prosecuting global warfare.

Recounting deficiencies as well as accomplishments, the authors point up the numerous problems which severely hampered transportation operations such as adverse climate, a paucity of trained personnel, extensive use of untrained combat troops and the lag of oversea commands in developing organizations that could give centralized and integrated direction to Army transportation activities.

While the several crises described picture the seriousness of such deficiencies, the work clearly indicates that the shortcomings discussed should serve to accent rather than detract from the achievements of the U. S. Army's overseas transportation operations.

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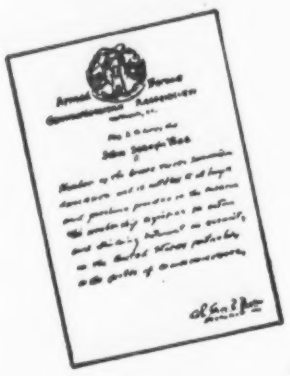

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